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ABSTRACT

The Committee on Capital Financing of the Council of Ontario Universities set up the Task Force on Building Costs in June 1971 to analyze in detail comparative building cost data. The first phase of the study involved describing and comparing in detail the initial costs and design requirements of a group of university and non-university buildings. The second phase is to investigate long-term cost and performance factors, including costs of maintenance and operation, and the effectiveness of the buildings in use. This report covers only the first phase of the study, the specific objectives of which were: (1) to develop an understanding of the components of cost in university and non-university buildings; (2) to develop and utilize a methodology that will enable the ready comparison of components of cost; and (3) to provide the necessary descriptive information so that a cost/design comparison might be undertaken. Also included is an extensive supplement that contains the elemental cost analysis and performance and statistical data on which the report is based. (Author/HS)

Council of Ontario Universities
Conseil des Universités de l'Ontario

Building Blocks

Background Studies on the Development of a Capital Formula for Ontario

VOLUME 4

Report of the Task Force BUILDING COSTS

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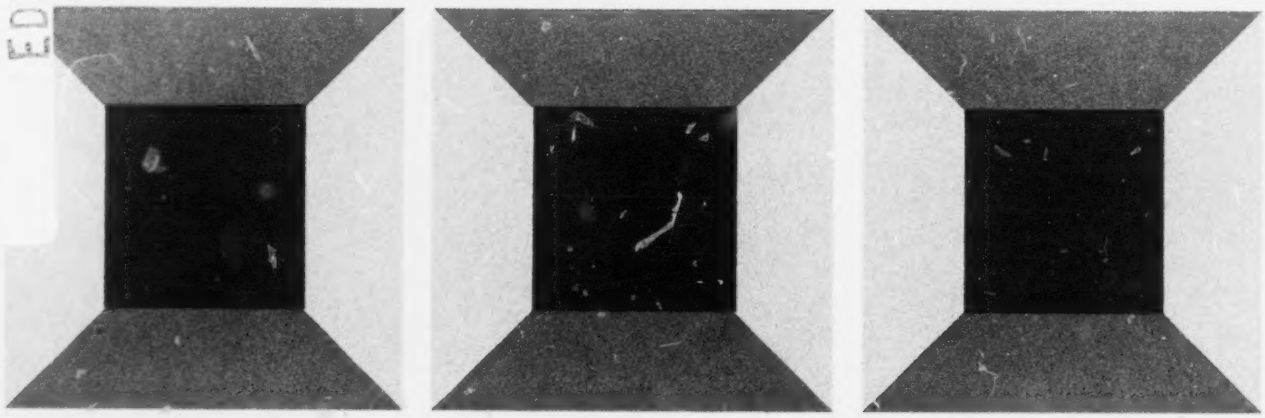

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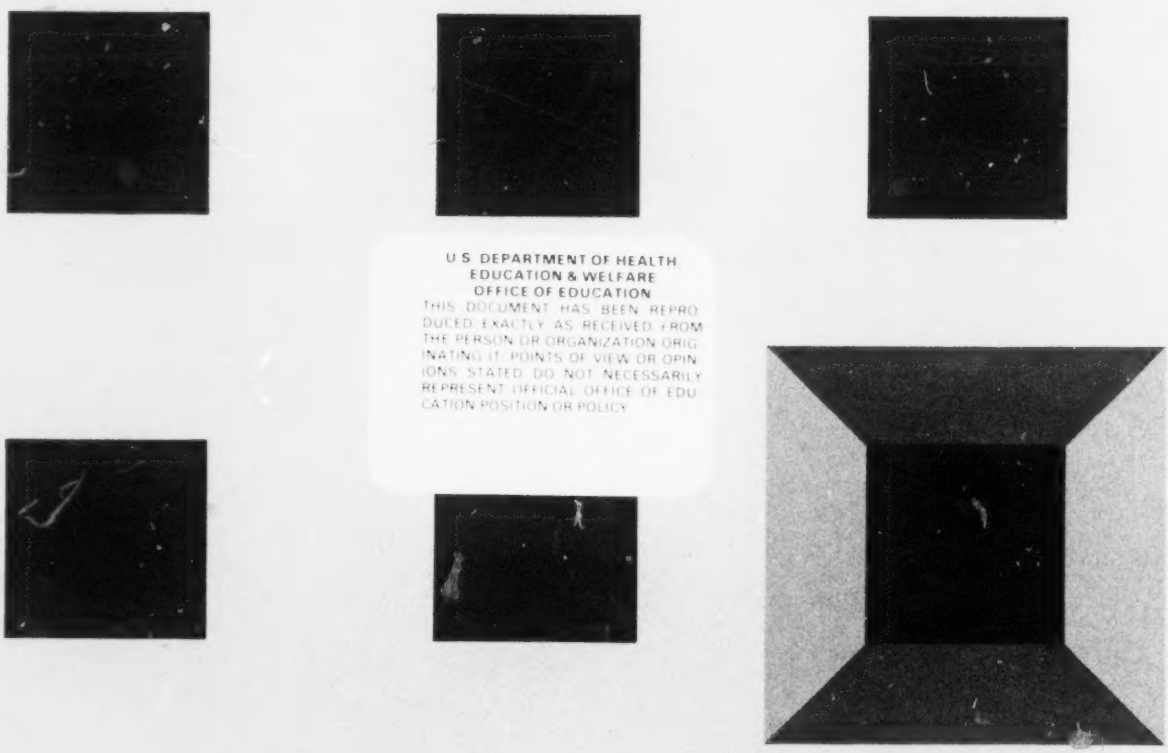

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REPORT OF

THE TASK FORCE - BUILDING COSTS

A COMPARISON OF THE COSTS OF BUILDING ELEMENTS RELATED TO DESIGN REQUIREMENTS FOR SELECTED UNIVERSITY AND NON-UNIVERSITY BUILDINGS IN ONTARIO

The Council of Ontario Universities
Conseil des Universités de l'Ontario
102 Bloor Street West
Toronto 181, Ontario

72-12
July 1972

TASK FORCE - BUILDING COSTS

Commissioner/Director,
Mr. C. Arnold,
Vice President, Building Systems Development,
San Francisco, California.

Mr. H. Graupner,
Head, Planning Department,
University of Guelph.

Mr. W. Morgan,
Director, Physical Plant and Planning,
University of Windsor.

Mr. A.R. Dawson,
Director, Campus Planning,
York University.

Mr. D.M. Hedden,
Vice President, Administration,
McMaster University.

Dr. G.R. Love,
Chairman, Committee on Capital Financing,
Carleton University.

Mr. J. Whenham,
Secretary, Committee on Capital Financing,
Carleton University.

Mr. I.W. Thompson,
Secretary 1971,
Council of Ontario Universities.

Mr. T. Da Silva,
Secretary 1972,
Council of Ontario Universities.

Hanscomb-Roy Associates,
Consultant,
Mr. B. Bowen, Partner-in-Charge,
Mr. S. Donnell, Project Leader.

The Task Force on Building Costs wishes to acknowledge the help of all those who provided information for this study. Special thanks are due to the architectural services branch of the Ministry of Colleges and Universities, the physical planning staffs of the universities, and the architects of all the buildings studied. The cooperation of the owners of the non-university buildings is particularly appreciated.

PREFACE

The Report of the Task Force - Building Costs has been received by the Committee on Capital Financing and its parent body, the Council of Ontario Universities. On the basis of recommendations from the Committee on Capital Financing, the Council at its meeting on June 2, 1972, agreed:

a. to accept the Report as a basis for negotiation with the Committee on University Affairs in reviewing the cost component of the capital formula;

b. to approve recommendations 6 and 7 of the Report (page 4);

c. to commend to member institutions recommendations 3 and 4 of the Report (page 4);

d. to refer to the Committee on Capital Financing and the Ontario Association of Physical Plant and Planning Administrators, for further consideration and advice, recommendations 1, 2 and 5 of the Report (pages 3 and 4). In particular the Committee on Capital Financing was requested to develop and submit to COU a specific proposal for Phase II of the study.

COUNCIL OF ONTARIO UNIVERSITIES
CONSEIL DES UNIVERSITÉS DE L'ONTARIO
102 BLOOR STREET WEST
TORONTO 181, ONTARIO
(416) 920-6865

ERRATA

1. p. 20. Floor plan title should read:
   Mathematics and Computer Building,
   University of Waterloo

2. p. 21. Photograph title should read:
   Mathematics and Computer Building,
   University of Waterloo

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BUILDING COST AND DESIGN REQUIREMENTS

SUMMARY

The Committee on Capital Financing of the Council of Ontario Universities set up the Task Force on Building Costs in June 1971 in order to analyse in more detail comparative building cost data such as that contained in the report "Cost Study: Interim report to the Committee on University Affairs", prepared by the Department of Colleges and Universities in December 1970. Such an analysis, would also provide data to universities, and be of great use in decision making associated with new building design and construction. A two-phase study was envisioned. The first phase would describe and compare in detail the initial costs and design requirements of a group of university and non-university buildings. The second phase would investigate long-term cost and performance factors, including costs of maintenance and operation, and the effectiveness of the buildings in use. This report covers only the first phase, the specific objectives of which were as follows:

(1) To develop an understanding of the components of cost in university and non-university buildings.

(2) To develop and utilize a methodology that will enable the ready comparison of components of cost.

(3) To provide the necessary descriptive information so that a cost/design comparison might be undertaken.

The study was concerned with the following major types of assignable space:

(1) Offices
(2) Classrooms
(3) Teaching laboratories
(4) Research laboratories

The method of analysis used was to arrive at building costs by re-estimating the cost of each building component, using actual cost for general validation and reconciliation. Costs were estimated as at one place and at one time viz, Toronto, last quarter 1971.

From a gross sample of about 80 buildings, the selection process produced a sample of six university and six non-university buildings. The selected sample, and the costs of the buildings, were as follows:

Highest costs underlined, lowest costs underlined.

University Buildings	Rank	Cost/GSF*	Cost/NASF*
Child Study Center (Ottawa)	4	$33.61	$54.28
Law Building (Windsor)	6	27.85	45.33
Crop Science Building (Guelph)	1	42.39	71.27
Petrie Science Building (York)	3	34.74	60.92
Maths & Computer Building (Waterloo)	7	24.26	38.38
Engineering IV (Waterloo)	2	36.80	62.33
Non-University Buildings			
Northern Electric Laboratory (Toronto)	8	24.14	32.56
Systems Dimension Limited Building (Ottawa)	10	22.58	29.17
Varette Office Building (Ottawa)	12	14.73	**
General Purpose Office Building (Ottawa)	11	17.17	**
Food & Drug Laboratory (Toronto)	5	32.04	62.86
Georgian CAAT (IIIA) (Barrie)	9	23.93	34.17

The analysis of elemental costs and design requirements resulted in the following findings:

a. Based on this sample, where university and non-university buildings have approximately like functions, mixes of space, and are similar in size, their costs were found to be comparable.

b. The cheapest buildings within the range studied were ones that were very large, very repetitive, very simple in plan form, and responded to a single generalized function, such as the provision of undifferentiated office space.

c. The combination of shell and services costs effectively decides the cost magnitude of the building. A high cost in these two groups of elements cannot be offset by low costs elsewhere.

d. The cost of services varies more than the cost of the shell, and is also a high cost element, hence it may exert more influence on the overall cost of the building than the shell: shell costs range from $13.30 to $4.82/GSF, or 3:1, and service costs range from $20.81 to $5.16/GSF, or 4:1.

e. The cost of interior finishes, including walls, floor and ceiling, has minimal effect on the overall cost of the building.

f. There is a great variation in fixtures and fittings cost. This variation is a direct result of the programmatic functions of the building.

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* See glossary for definitions of G.S.F. and N.A.S.F.
** NASF figures not applicable: see Section 6c for explanation

NOTE: Federal Tax rebate not deducted from University Projects costs.

g. Indirect costs of university buildings in this sample average $1.19/GSF greater than non-university buildings.

h. The overall cost of buildings is not consistent with the costs of their individual elements. A low-cost building may have some elements that are high in cost and, conversely, a high-cost building may have some low-cost elements within it.

i. There is a wider range of element costs than building costs. This finding confirms the need to look closely at element costs in order to gain understanding of the cost characteristics of a building.

j. Higher performance requirements cost more, and the study shows the magnitude of some of these costs, and also shows the complexity of the variables that influence the cost design relationship.

k. University buildings generally cost more because of a conscious attempt to provide good exterior quality and a university identity: this extra cost for the sample of buildings is approximately in the range of $1.10 to $1.73/GSF.

The Task Force also reviewed the development of a capital formula dollar allowance that would vary, depending on the type of building under consideration. However, it was agreed that the formula dollar allowance should remain a single, average figure, primarily because the single figure allows for more flexibility and is simpler to administer.

The study suggests that escalation of building costs of the studied sample was about 50% less than would be indicated by the Southam Index.

The Task Force study concluded with the following recommendations: *

1. The systematic cost/design analysis developed in this study should be applied to the continuing university construction program. In this way, a body of coherent building information will be developed which will be of immense value for future planning and cost control.

2. The cost/design information developed in this study provides essential data which could form the basis for the development of an appropriate systems building program for the Ontario University system. A study should be instituted to determine the objectives for future university buildings, to establish the cost/benefit parameters for such a program, to outline feasible alternative kinds of system programs, and to estimate potential benefits and constraints of such programs.

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*For an elaboration of these recommendations, see page 47

3. The data in this report provides a basis for establishing design and cost guidelines, for all building elements, to assist university architects and engineers. These guidelines should be developed by each university.

4. Each university should initially concentrate on setting guidelines for the cost characteristics of the shell of future projects.

5. The second phase of the study should be immediately implemented to include the study of life costs, including costs of maintenance, operations and change, and to analyse the validity of programmatic needs that result in higher design requirements and higher cost elements for buildings.

6. The capital formula dollar allowance should be formally reviewed annually by a joint DCU/COU staff committee not only to take escalation into account, but also new information arising from on-going studies and further experience.

7. Because even the most conservative estimates of a capital formula dollar allowance exceeds $55/NASF an upward adjustment should be made in the present unit cost allowance.

In addition to this report, a second publication is envisaged. It will consist exclusively of the detailed building cost data derived and used in the study. Readers wishing to delve further into the data base of the study should obtain copies of this publication which is expected to be available by August 30, 1972.

1. INTRODUCTION

a. Origins of the Building Cost Study

The Committee on Capital Financing (CCF) of the Council of Ontario Universities (COU) set up the Task Force on Building Costs in June 1971 in order to analyse in more detail comparative building cost data such as that contained in the report "Cost Study: Interim report to the Committee on University Affairs", prepared by the Department of Colleges and Universities (DCU) in December 1970. Such an analysis would also provide data to universities and be of great use in decision making associated with new building design and construction. The DCU study was the first to demonstrate the difference between costs of Ontario University buildings, as a group and costs of a number of non-university buildings. However, it did not attempt to show in detail what makes up the cost of a building or to systematically explain the cause of the demonstrated difference. It did not analyse the design requirements of the buildings for which costs were being compared.

The intention of the COU Task Force was to carry out these analyses as an amplification of and a complement to the DCU study. The CCF envisaged a two-phase effort for this study. First, an examination and analysis of the average unit costs of university and comparable non-university buildings would be undertaken. Second, explanations of any differences brought to light and recommendations as to the standards to which universities in Ontario should build in the immediate future would be made. This latter phase, a much more complex and difficult one, was thought to require a critical examination of costs over the life-times of the buildings, not just initial costs. The CCF went on to recommend that the Ontario Association of Physical Plant and Planning Administrators (OAPPPA) be asked to propose the membership of a group to undertake the first phase and a methodology for carrying out the first step, with the aid of outside consultants engaged and paid for by the Council of Ontario Universities (COU).

The CCF report was presented at the May 14 meeting of COU by Dr. Ross Love. In the ensuing discussion of the proposal, the Committee agreed that the building cost study should proceed under COU auspices, that the Committee on University Affairs (CUA) and DCU should be kept informed about its progress, and that CUA should be invited to express its views concerning the building and cost comparisons employed in the study.

Subsequently, the Executive Director of COU wrote to Dr. Wright, the Chairman of CUA, informing him of the proposed building cost study and soliciting his views on the subject. Dr. Wright in reply stated that any competent work in the area of building costs analysis would be of value.

At the following meeting of COU on June 11, 1971, Dr. Love presented the views of the CCF regarding the conduct of the study. It was the opinion of the CCF that the Task Force on Building Costs should be composed of a commissioner-director, a five-man steering committee and a firm of cost consultants and the responsibilities of each member group were stated. Three of the five members on the steering committee were to be appointed by the OAPPPA and two by the CCF. It was intended that the commissioner-director would be appointed by the CCF and, following this, the cost consultant

appointed jointly by the commissioner-director and the steering committee. The three members of the steering committee appointed by the OAPPPA were Mr. Ross Dawson of York University, Mr. Henry Graupner of the University of Guelph, and Mr. William Morgan of the University of Windsor, while the CCF appointed Mr. Michael Hedden of McMaster University and Dr. Ross Love of Carleton University, the latter being expected to serve as chairman and coordinator in the absence of the commissioner-director.

On June 30, 1971, Mr. Christopher Arnold of Building Systems Development, San Francisco, was offered and accepted the position of commissioner-director, and on August 24, 1971, the firm of Hanscomb-Roy Associates was retained as consultant for the project.

b. Objectives and Scope

On July 27, 1971, the members of the task force convened to make explicit the terms of reference, the objectives, the scope and depth of the study, and the responsibilities of those involved. The terms of reference agreed upon were as follows:

(1) To document the costs of university buildings.
(2) To audit the university buildings to be included in the study.
(3) To document and analyze the costs of the various components of university buildings.
(4) To select, document and analyze the costs of non-university buildings to be included in the study.

The specific objectives of the first phase of the study were defined to be:

(1) To develop an understanding of the components of cost in university and non-university buildings.
(2) To develop and utilize a methodology that will enable the ready comparison of components of cost of university and non-university buildings.
(3) To provide the necessary descriptive information so that a cost/design comparison may be undertaken.

Two of the major aspects of the study to be considered were the type and the number of buildings to be included. After some deliberation buildings containing the following major types of space were accepted for inclusion:

(1) Office space
(2) Classrooms
(3) Teaching laboratories
(4) Research laboratories.

Special-purpose buildings such as gymnasia were excluded, and it was recognized that the final selection of building types might be dependent on the non-university buildings available for study.

Subsequently, a sub-sample of six non-university buildings was chosen for detailed study.

The use of a sample of twelve buildings was primarily the result of limited time and resources. It was recognized that such a small sample would not provide results of any precise statistical validity and the results have not been interpreted in detail on a statistical basis, nor have general conclusions been arrived at on this basis. However, the use of a small sample enables each building to be analyzed and compared with others in depth on an individual basis.

In addition, since the DCU list was limited both in total number of buildings (approximately 40) and in the types of buildings, the list was expanded by the addition of several other buildings before the sample of six buildings was selected. The university buildings considered for inclusion are shown in Section 8a.

The method of selecting a sub-sample of six university buildings for further study was as follows: The DCU Project Cost Space Record for each project was used to review and subjectively classify the projects into two categories, viz: light and heavy service. * Next, the cost per net assignable square foot of each building in the two categories was adjusted by the Composite Southam Construction Index, Ontario Series, to August 1971, and separately ranked for each category in descending order of adjusted unit cost. The Southam index was used only for this preliminary selection process. Finally, from each of the two lists the 25th, 50th and 75th percentile buildings were selected.

The consultants were then provided with the following information for each of the buildings selected:

(1) Tender set of working drawings
(2) Tender building specifications and all relevant addenda.
(3) Tender form submitted by the successful contractor.
(4) Contractors' progress payment schedule.
(5) All other relevant documents pertaining to cost.
(6) Bid record sheet indicating spread of bids.

In addition to the above, basic performance information about each building was collected on a form prepared by the commissioner-director and the consultant.

The procedure for selecting a sub-sample of six non-university buildings differed from that employed for university buildings in that cost per gross square foot was used as the ranking basis instead of cost per net assignable square foot. This was necessary because only data on gross square footage were available for all of the non-university buildings. In addition, detailed information on non-university buildings, particularly in the heavy-service category, was relatively scarce. It was not possible, within the time and resources available for the study, to develop a gross sample, as for the university buildings,and select buildings on a percentile basis. Hence, buildings were selected by inspection on the basis that they conformed to the following criteria:

* For preliminary selection, light and heavy service were defined by the title of the building, with science and engineering buildings assumed to be heavy service buildings.

2. GENERAL DESCRIPTION OF THE METHODOLOGY EMPLOYED

a. Methods of Analysis

Two alternate cost analysis methodologies were considered and discussed. The first method was to arrive at the building cost by re-estimating the cost of each building component, using actual cost for general validation and reconciliation. This method has the advantages of uniformity of estimating and of assumptions, and can be used where actual costs are not reliable or are suspect. In addition, cost differentials between projects due to time and location variables are eliminated. Disadvantages may be a lack of credibility, since the basic comparisons of elements are based on estimates rather than a contractor's breakdown.

The second method is to work back from the actual cost and the contractor's breakdown. This method has the advantage of using known costs as a base and gains in credibility. Disadvantages include questions of the reliability of contractor's breakdown and the validity of cost information of some private work, the difficulties of interpretation and translation of trade breakdowns into elemental costs, and the extreme difficulty of isolating time and location cost variables for comparison purposes. The question of differences in cost arising out of geographical location was not considered, not because the differences are not real or important but because of limitations on the time and resources available to the Task Force. Thus the method of estimating building costs used in this report deliberately excludes any attempt to compensate for differences in geographical location.

After much discussion, the first approach was chosen. Thus the method of cost analysis was to:

(1) Estimate projects from scratch, on an elemental cost basis.
(2) Use known cost as validation and control.
(3) Estimate as at one place and at one time viz, Toronto last quarter 1971.

b. Selection of Samples

The next step was to select a sub-sample from a gross sample of 39 university buildings included in the DCU study. The sub-sample consisted of six university buildings to be analysed in detail while the gross sample conformed to the following criteria:

(1) Only buildings costing over $1,000,000 were included.
(2) Only buildings included in the DCU categories of Administration, Science, Engineering, Arts, Law and Education were regarded as candidates for inclusion.
(3) Only buildings tendered from 1966 to the present were included in the first selection; buildings in the sub-sample must have been occupied by April 1, 1971.
(4) Buildings were not additions or extensions to existing buildings.*
(5) Buildings did not have unusual features of design, site condition, or other characteristics that might make comparison unrepresentative.

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* This criterion was waived in the case of the Engineering IV Building (Wa35). This is a large extension to an existing building and was judged discrete and large enough to be included.

(1) The detailed information noted above was available for each building.
(2) Only buildings costing over $1,000,000 were included.
(3) Buildings selected fitted one of the following categories:

(a) Owner-occupied commercial office.
(b) Speculative commercial office.
(c) Research laboratory - Commercial
(d) Research laboratory - Government/Institutional.
(e) Office building - Government
(f) High school/College of Applied Arts & Technology (CAAT)/ Vocational school

(4) Buildings were tendered during the period 1966 to the present and occupied by April 1, 1971. *
(5) Buildings were not additions or extensions to existing buildings.
(6) Buildings did not have unusual features of design, site condition, or other characteristics that might make comparison unrepresentative.

The gross sample of non-university buildings was gathered from a variety of sources, including the Federal Public Works Department, the Provincial Government, Atomic Energy of Canada Ltd., the Ontario Department of Education, the Toronto Board of Education and from projects known or worked on by the consultants. Section 8a shows the non-university buildings considered for inclusion in the detailed sample.

c. The Buildings Studied

The twelve buildings studied in detail are as follows:

University buildings:

Ottawa 34 - Child Study Center Building
Windsor 24 - Law Building
Guelph 04 - Crop Science Building
York 26 - Petrie Science Building
Waterloo 17 - Mathematics and Computer Building
Waterloo 35 - Engineering IV Building

Non-university buildings:

Northern Electric Laboratory - Toronto
Systems Dimensions Limited Building - Ottawa
Varette Office Building - Ottawa
General Purpose Office Building - Ottawa
Food and Drug Building - Toronto
Georgian CAAT (IIIA) - Barrie

The university buildings were specially visited by a majority of the Task Force and all of the buildings were visited by at least one member of the Task Force.

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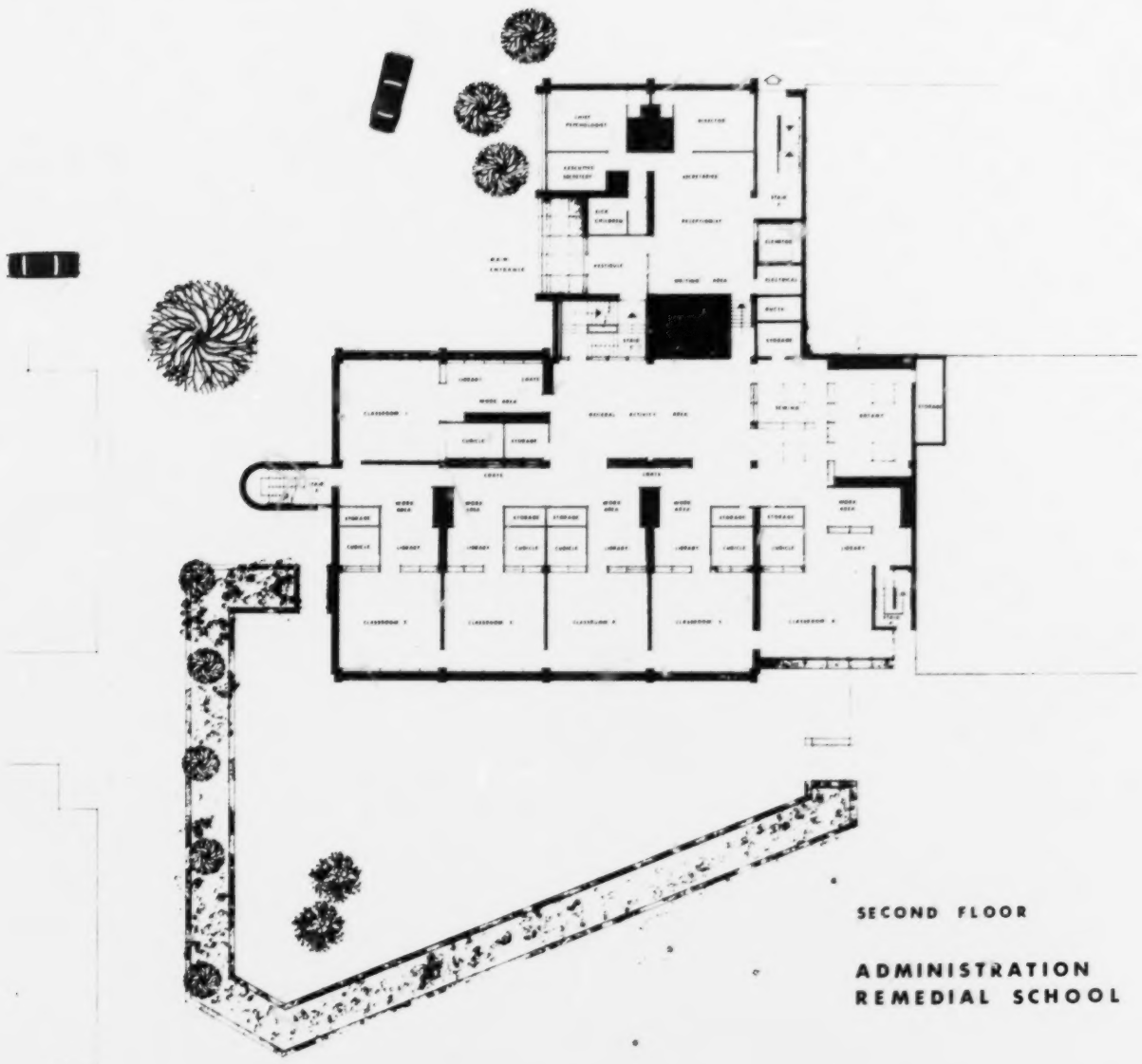
* Because of the difficulties in procuring adequate information in the time available, this criterion was waived in the case of the Food and Drug Building, which was tendered on November 1971.

For identification purposes a general exterior photograph and a plan of a typical floor are shown. In two cases, the General Purpose Office Building and Varette, a drawing is shown instead of a photograph. No plans or photographs of the Food and Drug Laboratory were available. The names of the architect and general contractor for each building are also provided.

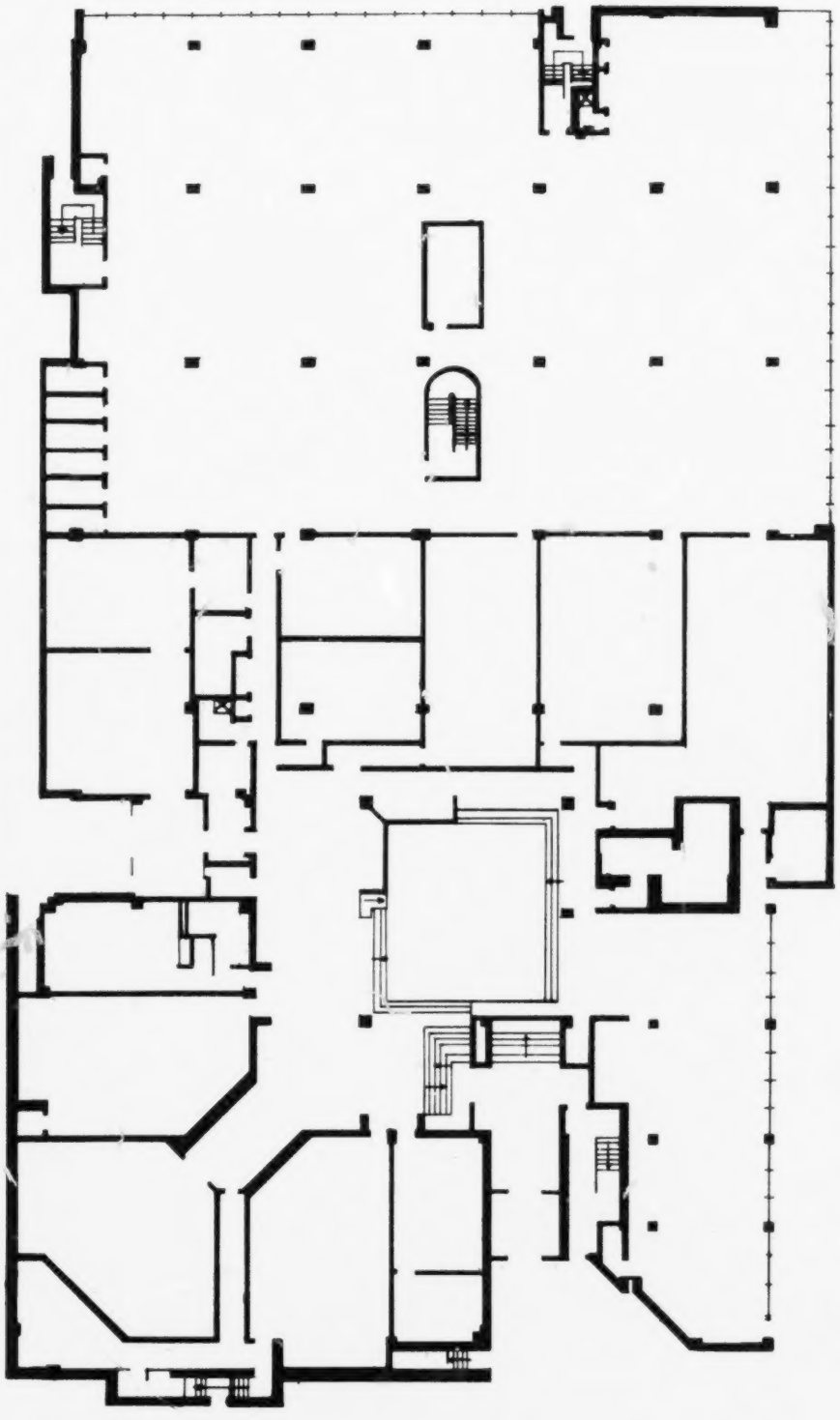
PLANS AND PHOTOGRAPHS OF ELEVEN

OF THE TWELVE BUILDINGS STUDIED



Child Study Centre, University of Ottawa

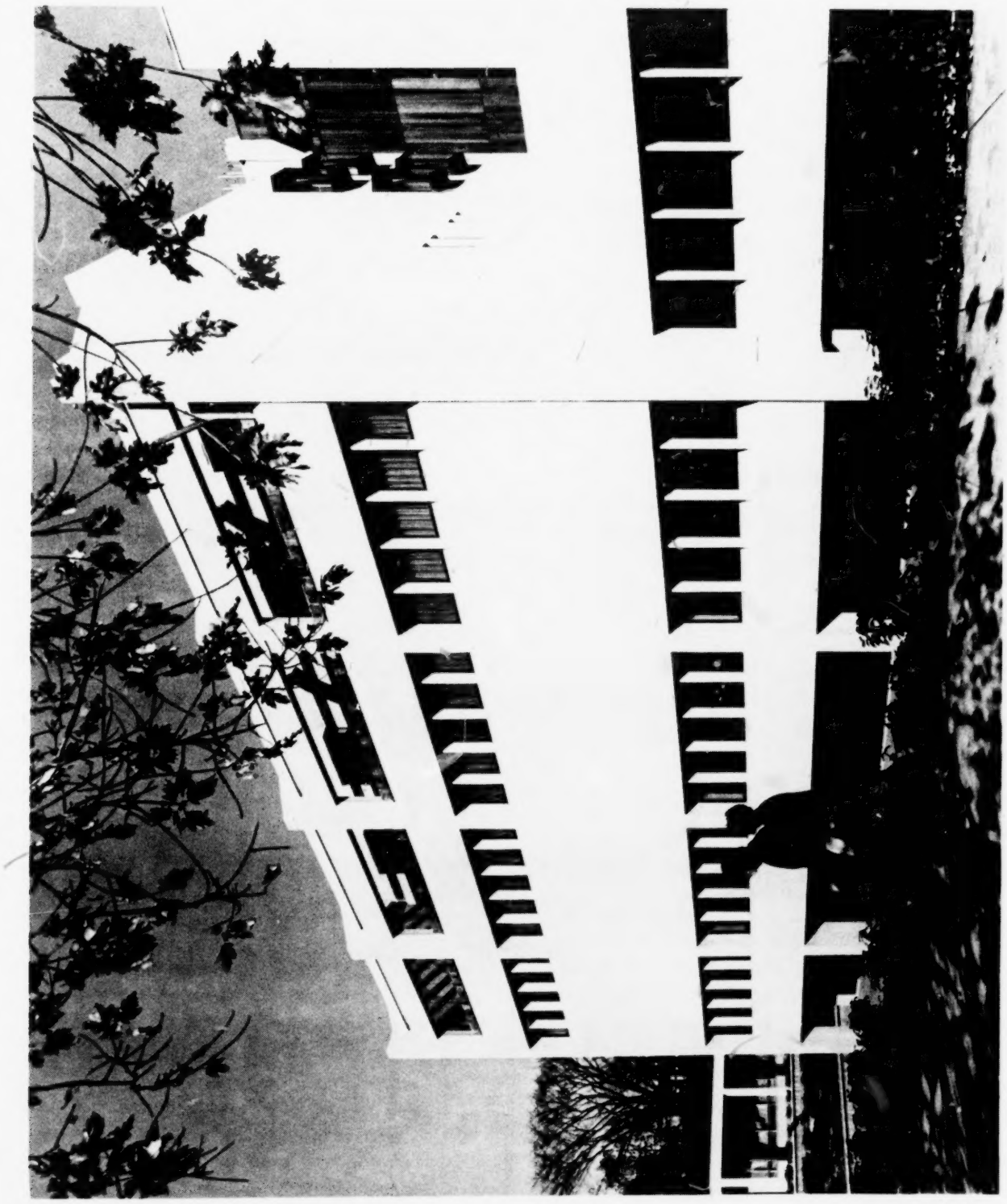
Architects: Schoeler, Heaton, Harvor, Menendez, Ottawa
General Contractor: Admiral Engineering and Construction Ltd., Ottawa



GROUND FLOOR PLAN

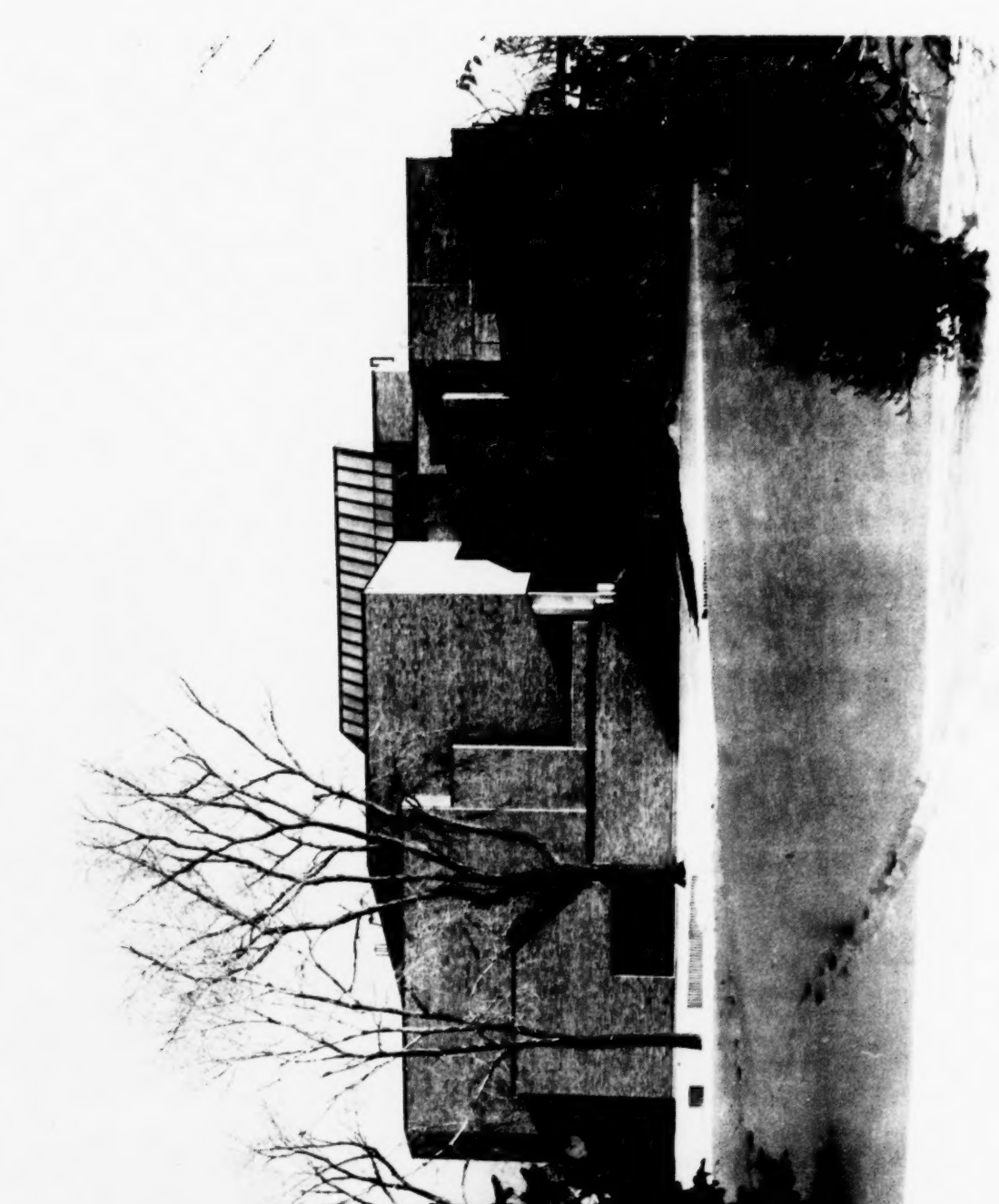
Faculty of Law Building, University of Windsor

Architects: Gordon S. Adamson and Associates, Toronto
General Contractor: W.A. McDougall Ltd., London



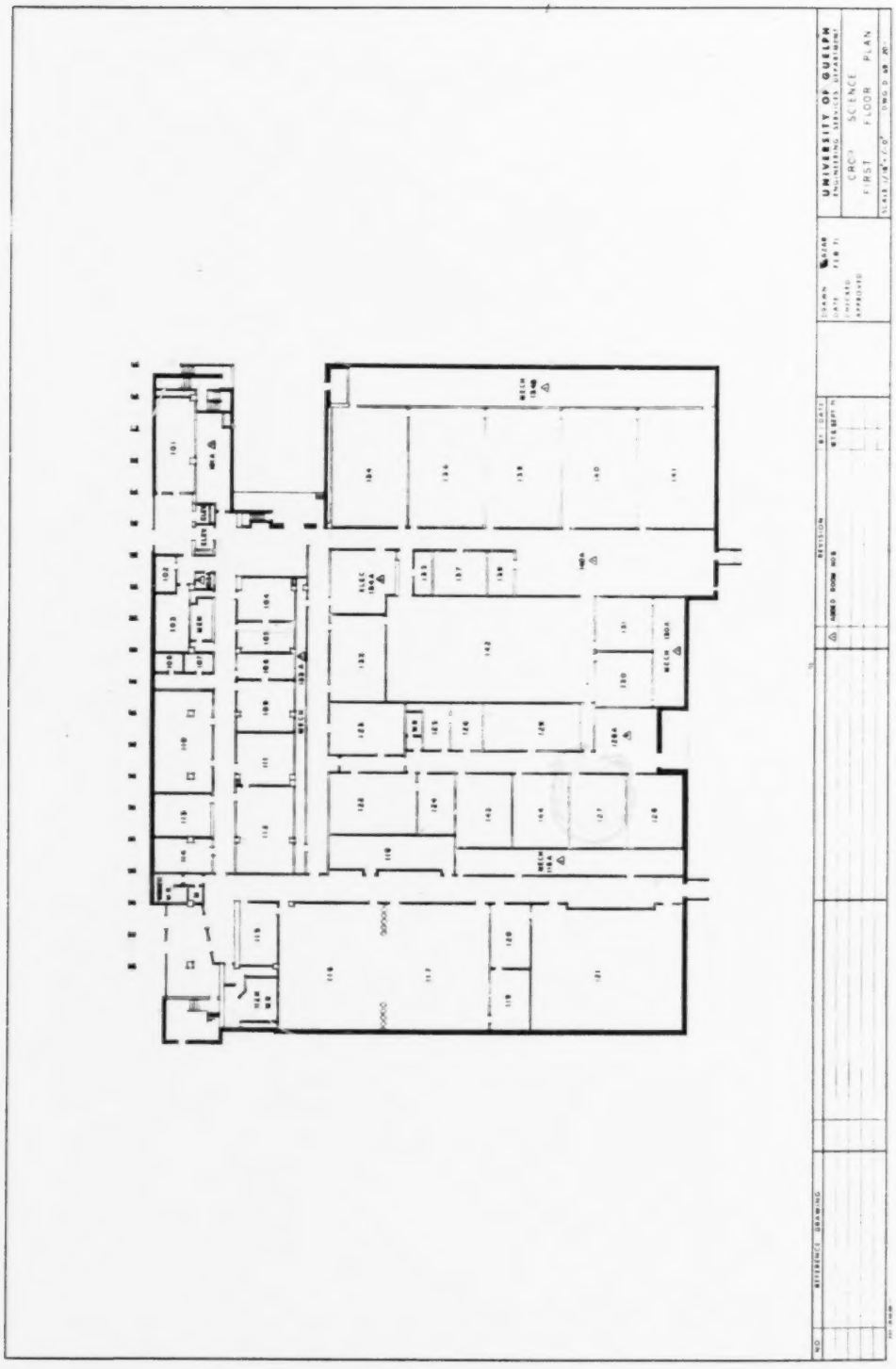
Child Study Centre, University of Ottawa

Architects: Schoeler, Heaton, Harvor, Menendez, Ottawa
General Contractor: Admiral Engineering and Construction Ltd., Ottawa



Faculty of Law Building, University of Windsor

Architects: Gordon S. Adamson and Associates, Toronto
General Contractor: W.A. McDougall Ltd., London

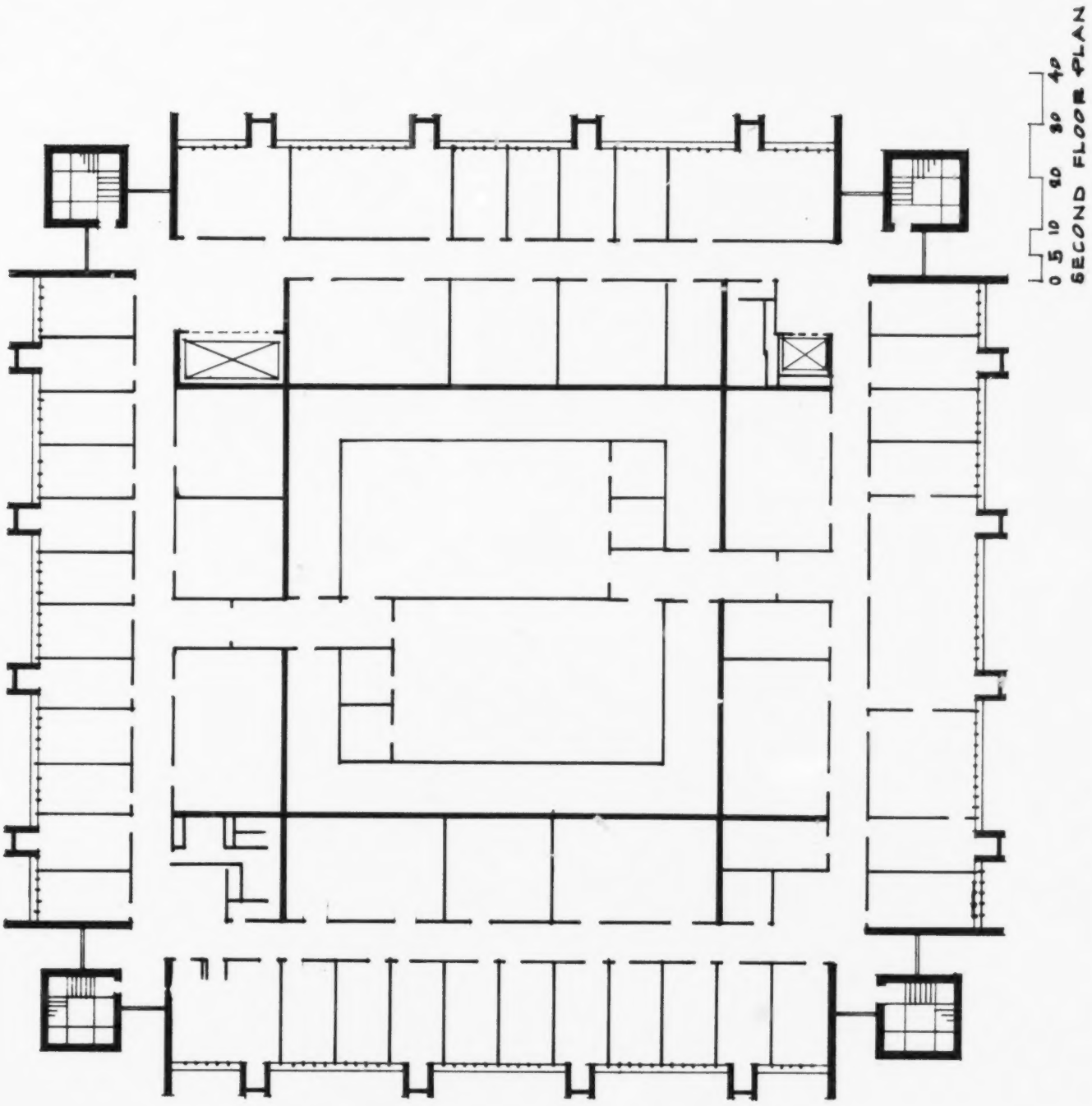


Crop Science Building, University of Guelph

Architects: Herbert Agnew Associates, Toronto
General Contractor: E.G.M. Cape & Company (1956) Ltd., Toronto

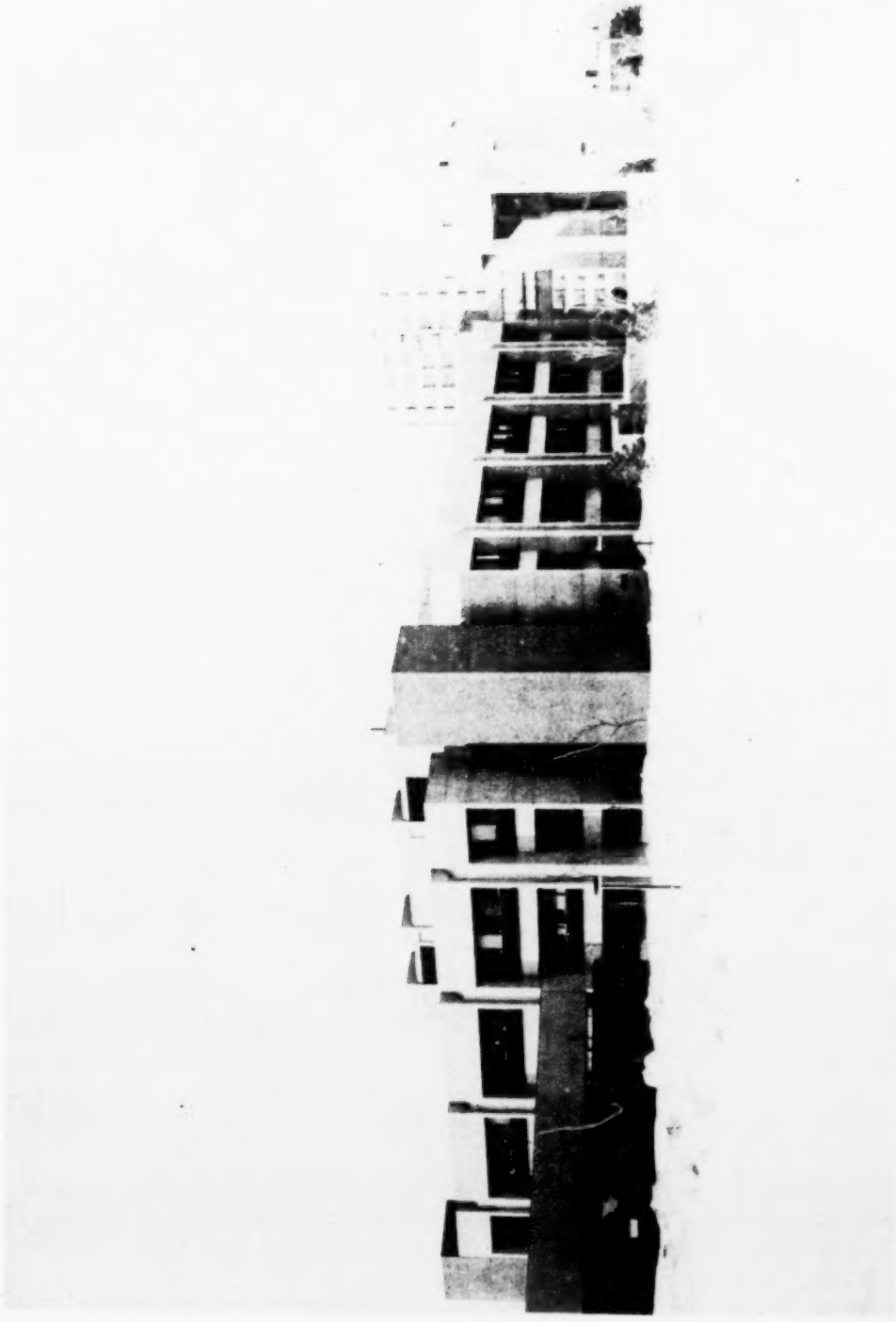
Crop Science Building, University of Guelph

Architects: Herbert Agnew Associates, Toronto
General Contractor: E.G.M. Cape & Company (1956) Ltd., Toronto



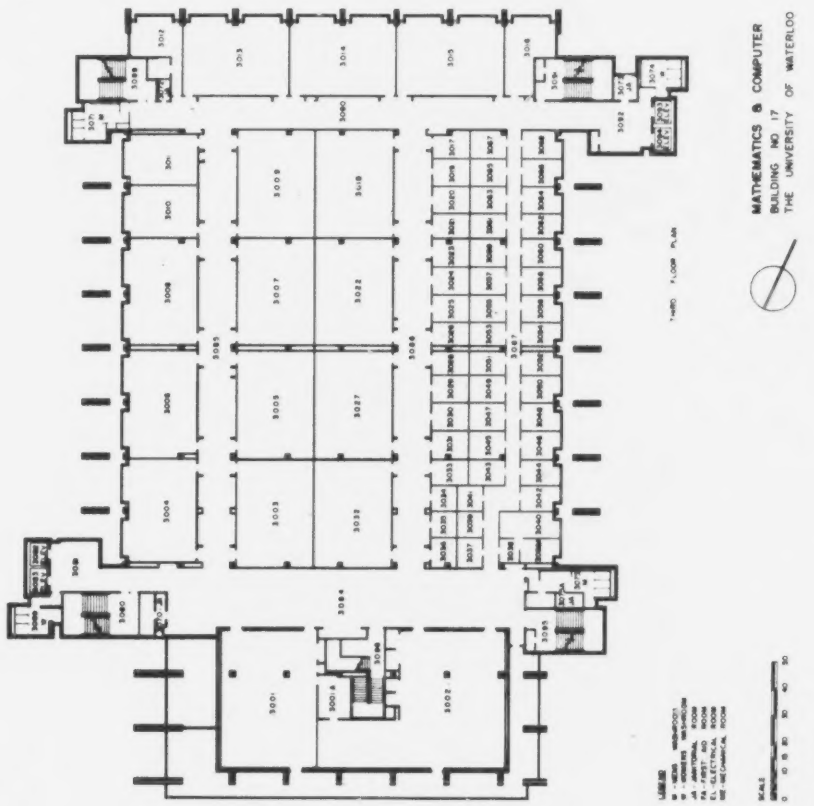
Petrie Science Building, York University

Architects: U.P.A.C.E., Toronto
General Contractor: Eastern Construction Company Limited, Toronto



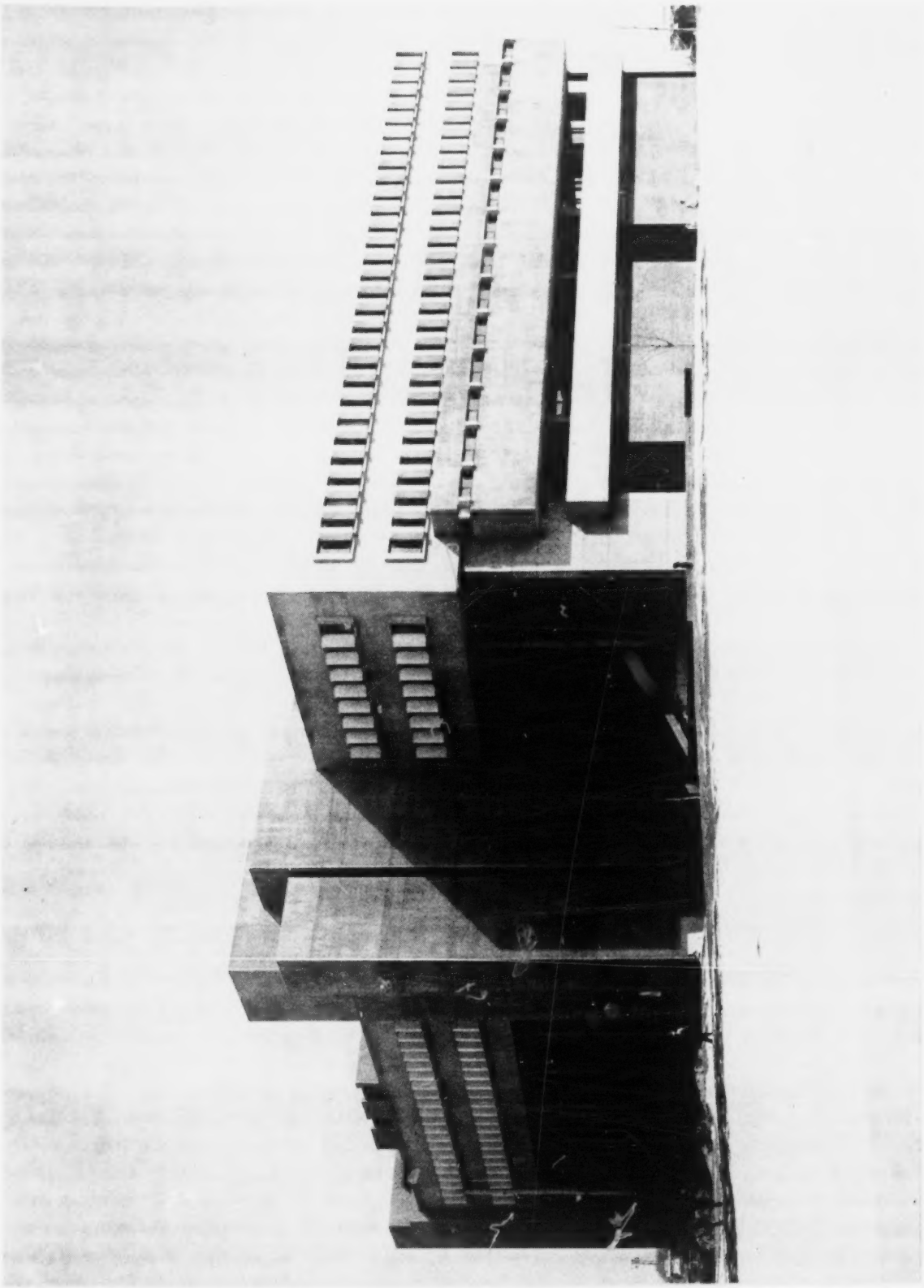
Petrie Science Building, York University

Architects: U.P.A.C.E., Toronto
General Contractor: Eastern Construction Company Limited, Toronto



Mathematics and Computer Building, University of Toronto

Architects: Webb, Zerafa, Menkes & Matthews, Toronto
General Contractor: Ellis-Don Limited, London



Mathematics and Computer Building, University of Toronto

Architects: Webb, Zerafa, Menkes & Matthews, Toronto
General Contractor: Ellis-Don Limited, London

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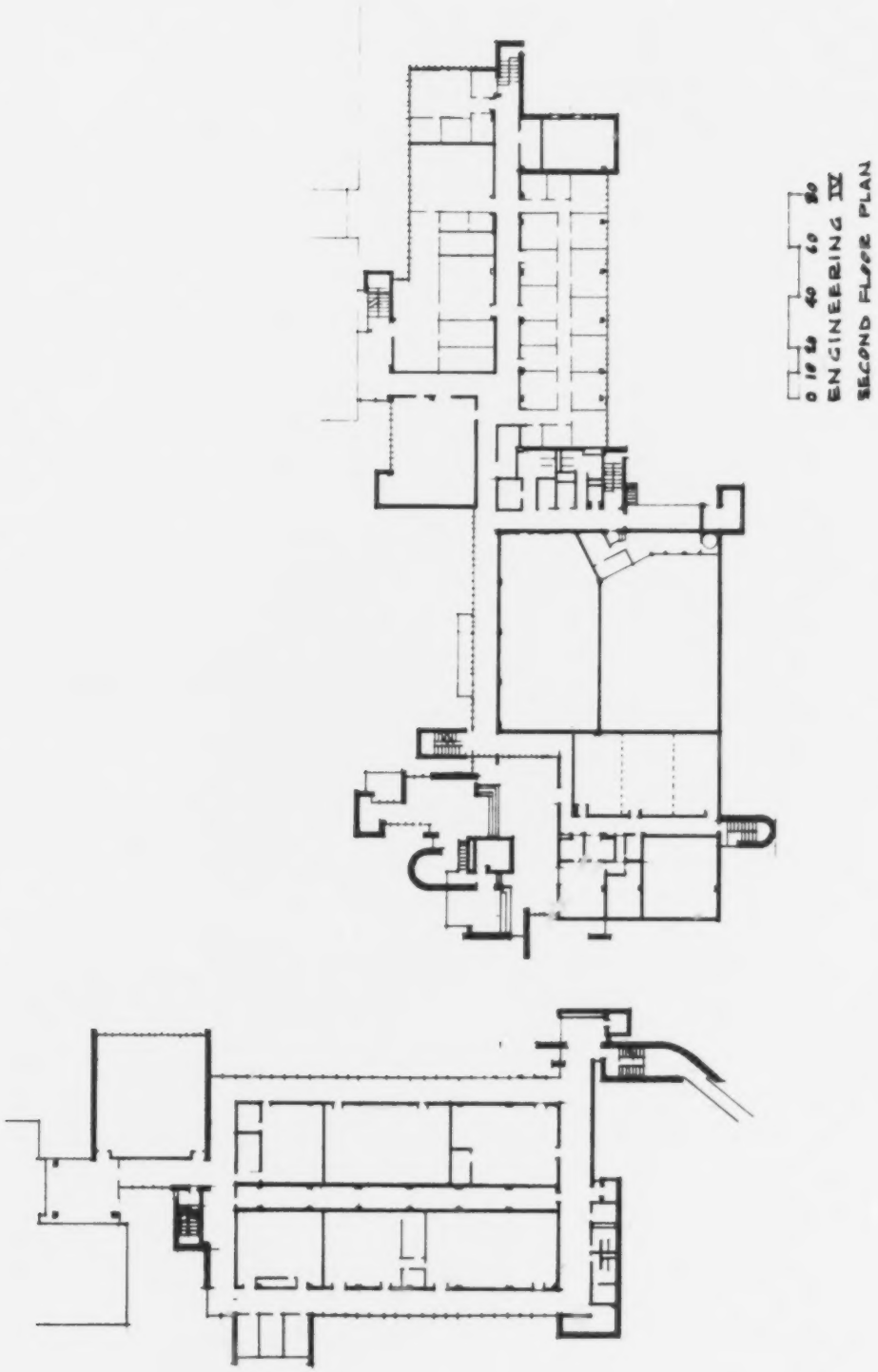
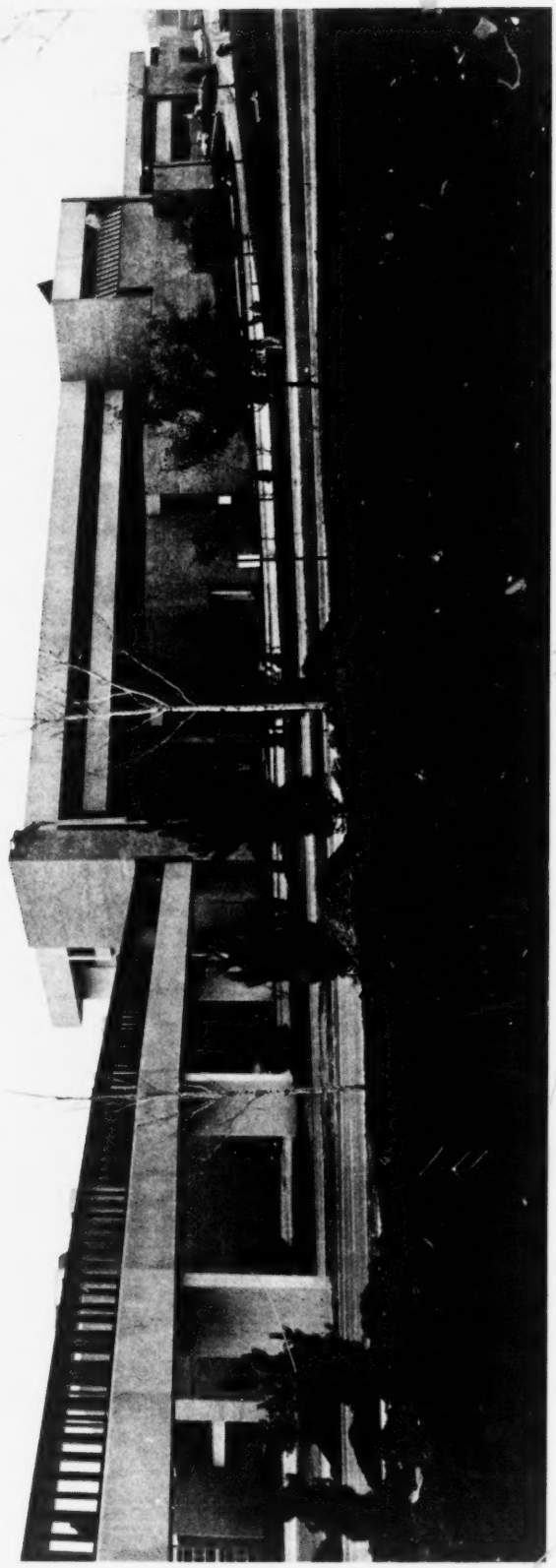


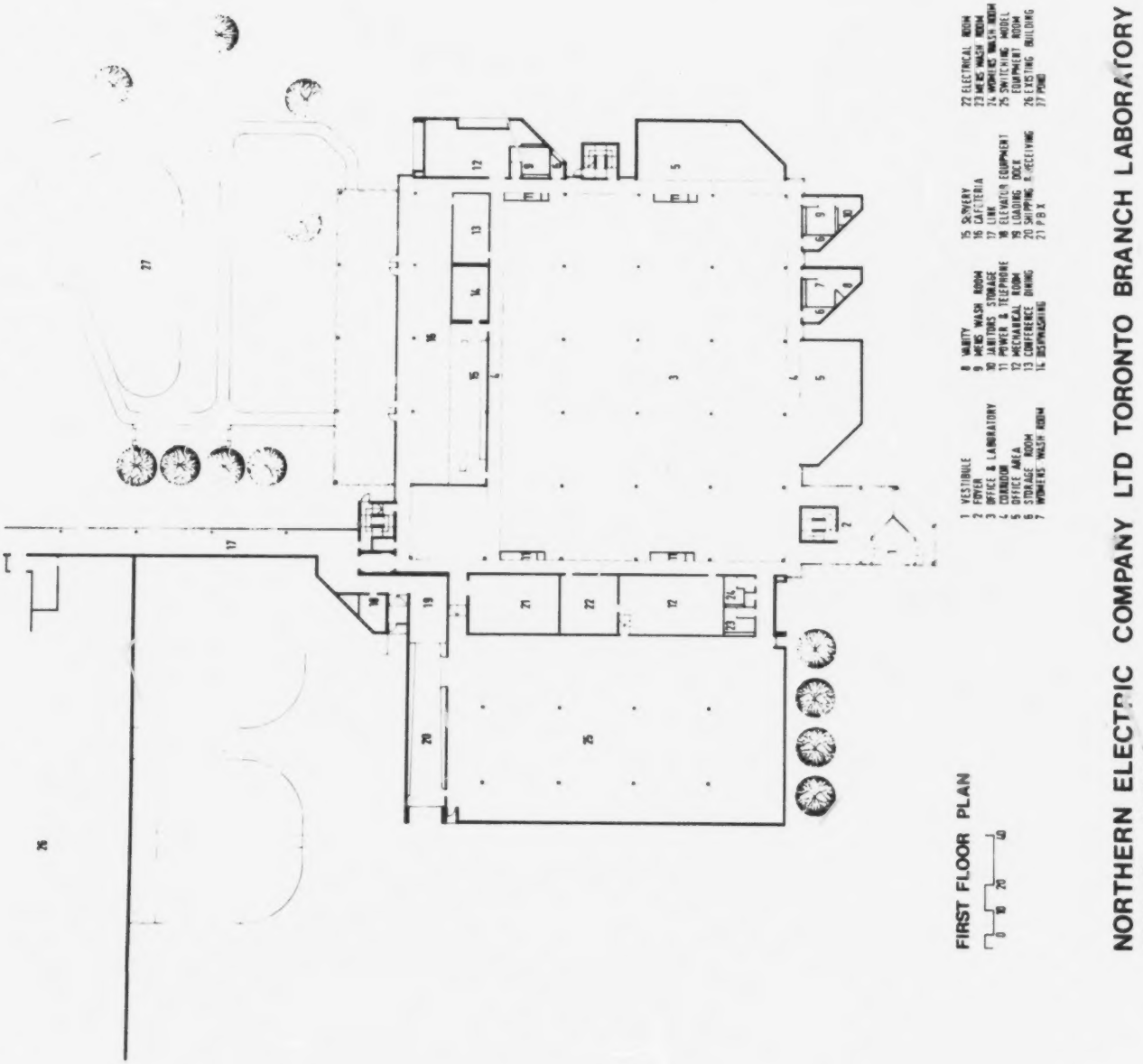
Engineering IV Building, University of Waterloo

Consulting Engineers: Giffels Associates Limited, Toronto
General Contractor: Ellis-Don Limited, London



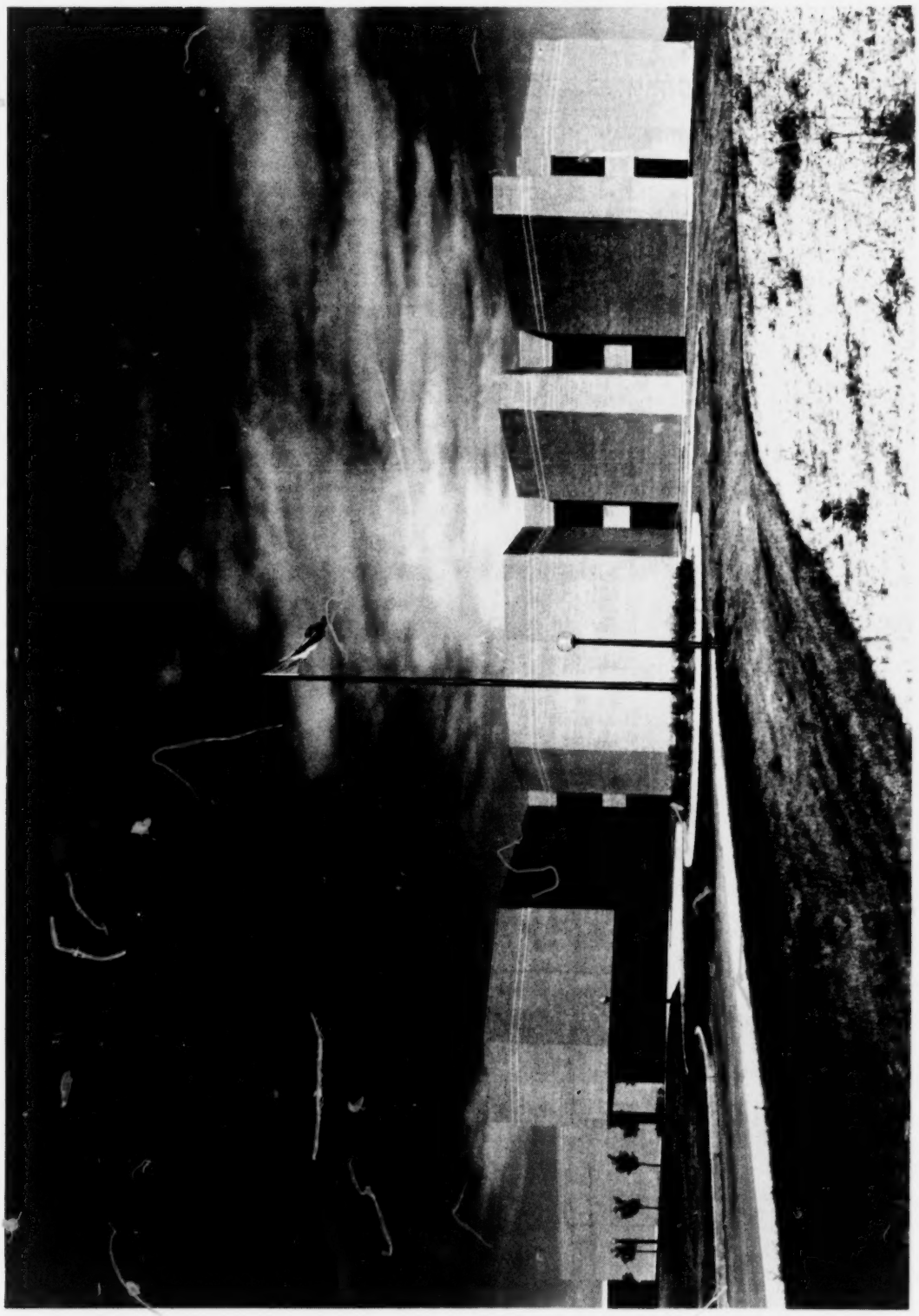
Engineering IV Building, University of Waterloo

Consulting Engineers: Giffels Associates Limited, Toronto
General Contractor: Ellis-Don Limited, London



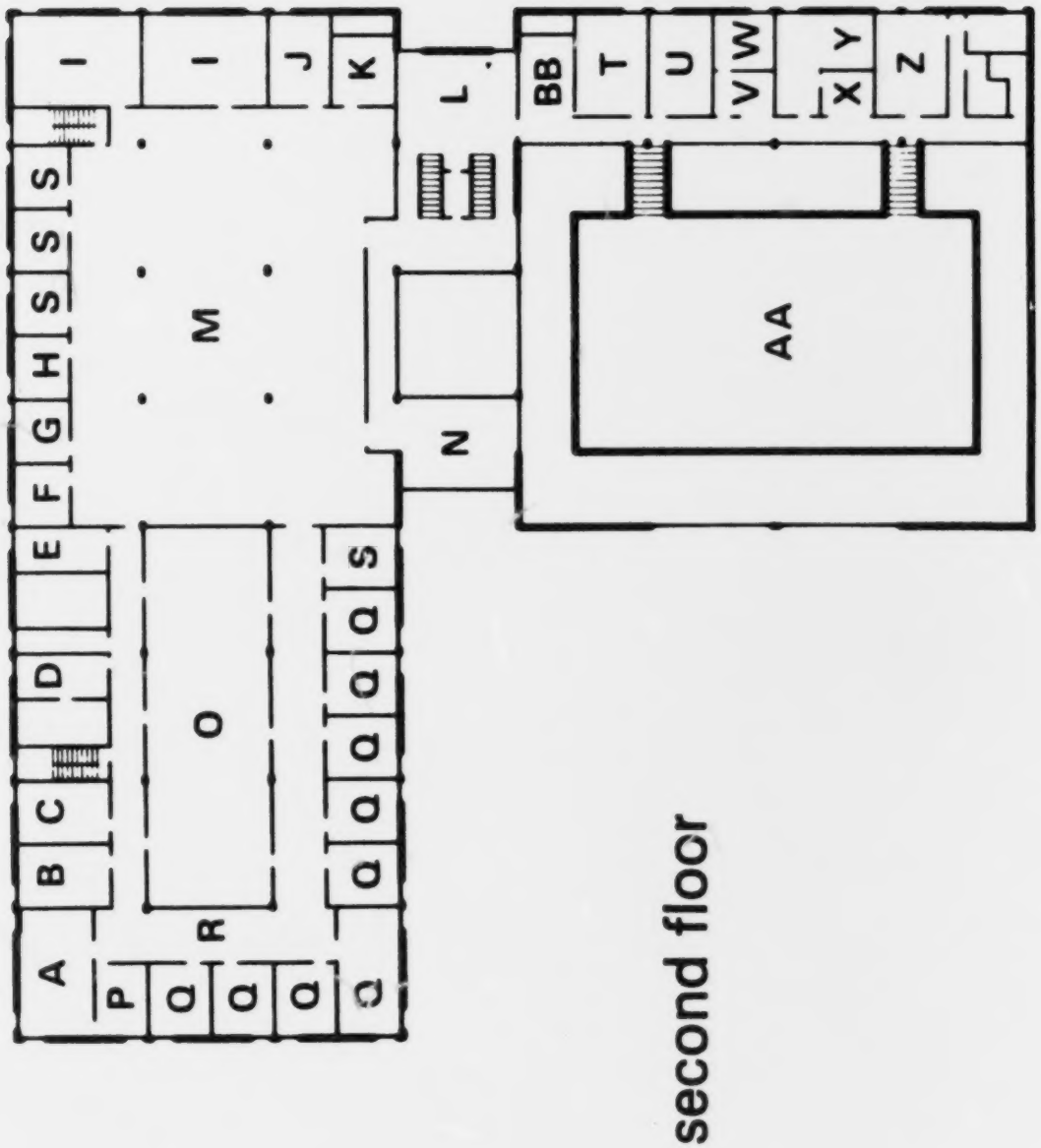
Northern Electric Branch Laboratory, Toronto

Architects: Gordon S. Adamson & Associates, Toronto
General Contractor: The Mitchell Construction Company (Canada)



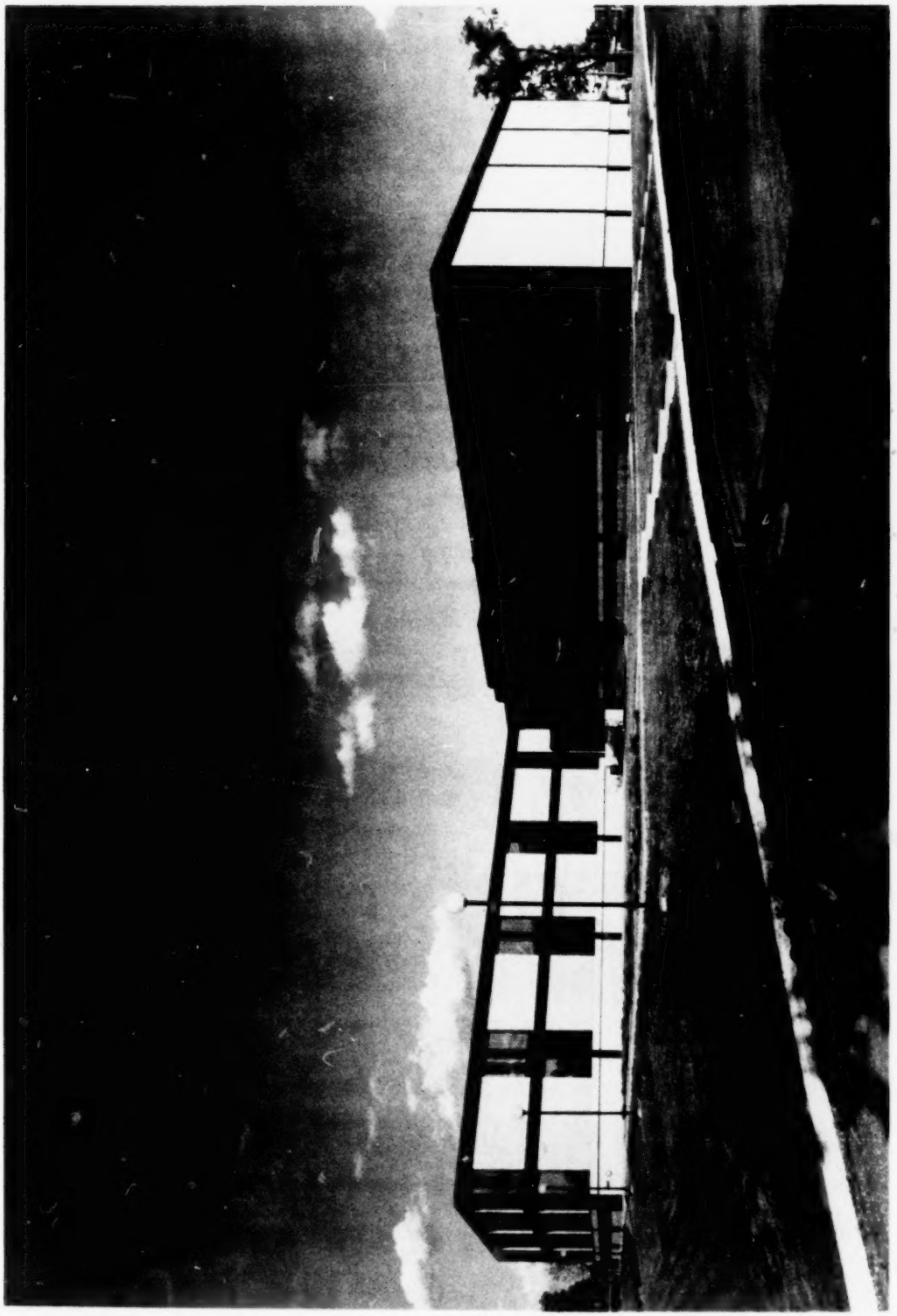
Northern Electric Branch Laboratory, Toronto

Architects: Gordon S. Adamson & Associates, Toronto
General Contractor: The Mitchell Construction Company (Canada)



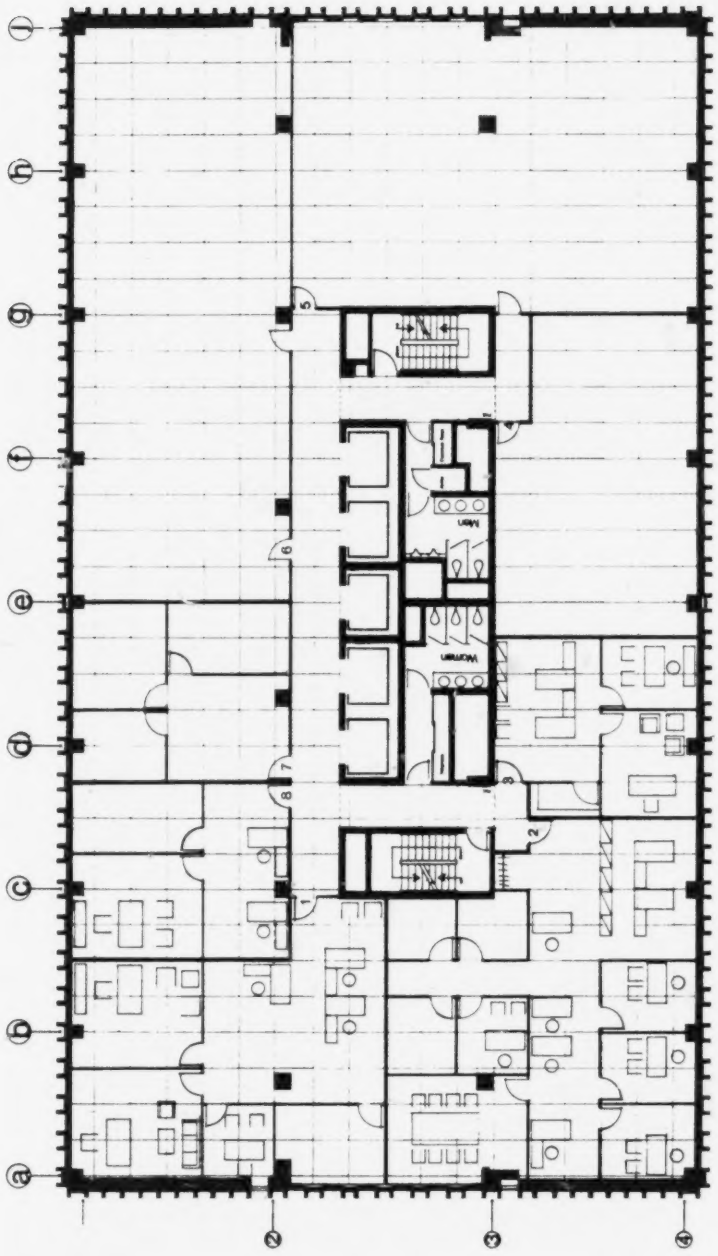
Systems Dimensions Limited Building, Ottawa

Architects: Murray & Murray, Ottawa
General Contractor: L'Abbe Construction Ltd., Ottawa



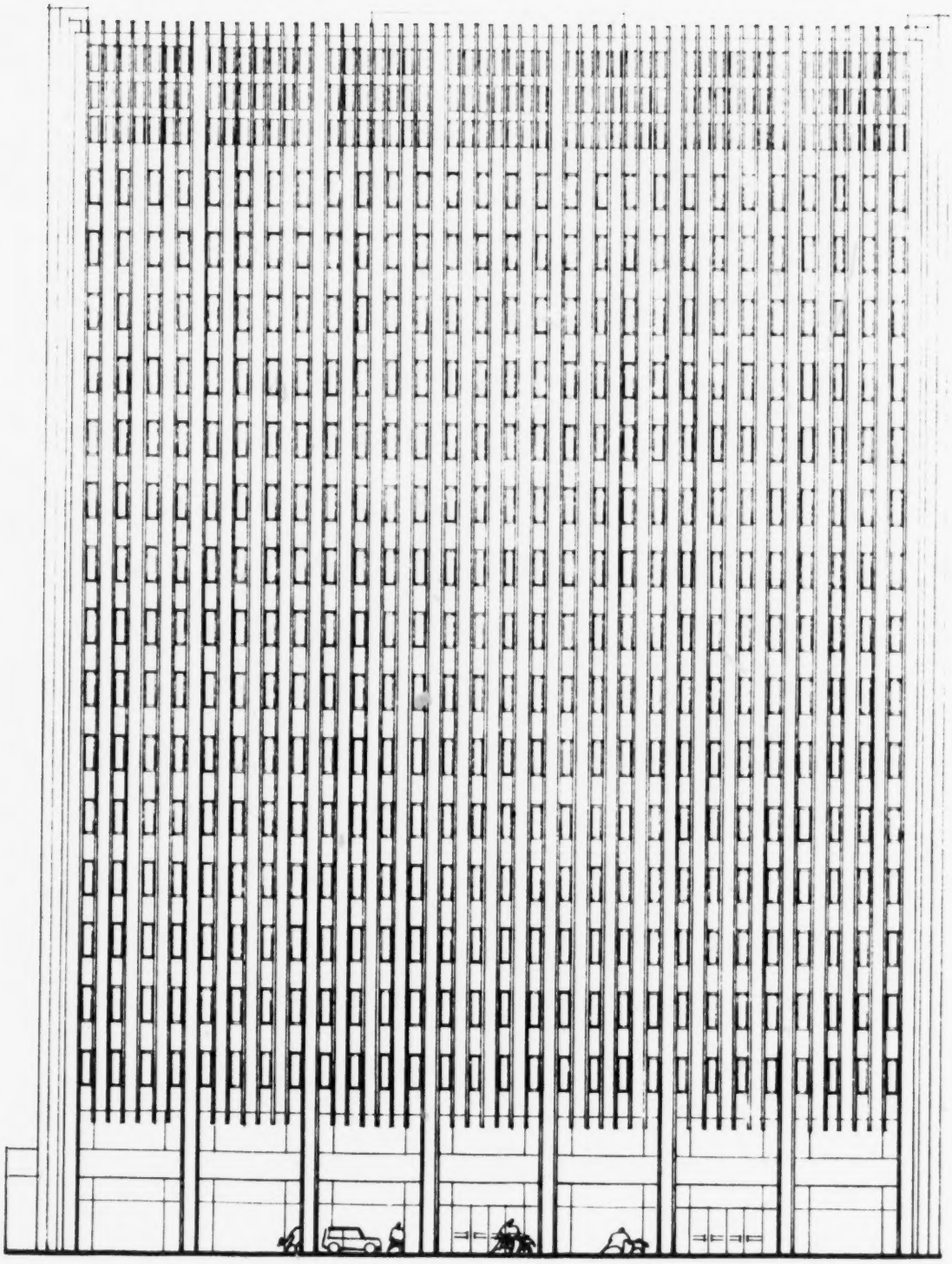
Systems Dimensions Limited Building, Ottawa

Architects: Murray & Murray, Ottawa
General Contractor: L'Abbe Construction Ltd., Ottawa



Varette Office Building, Ottawa

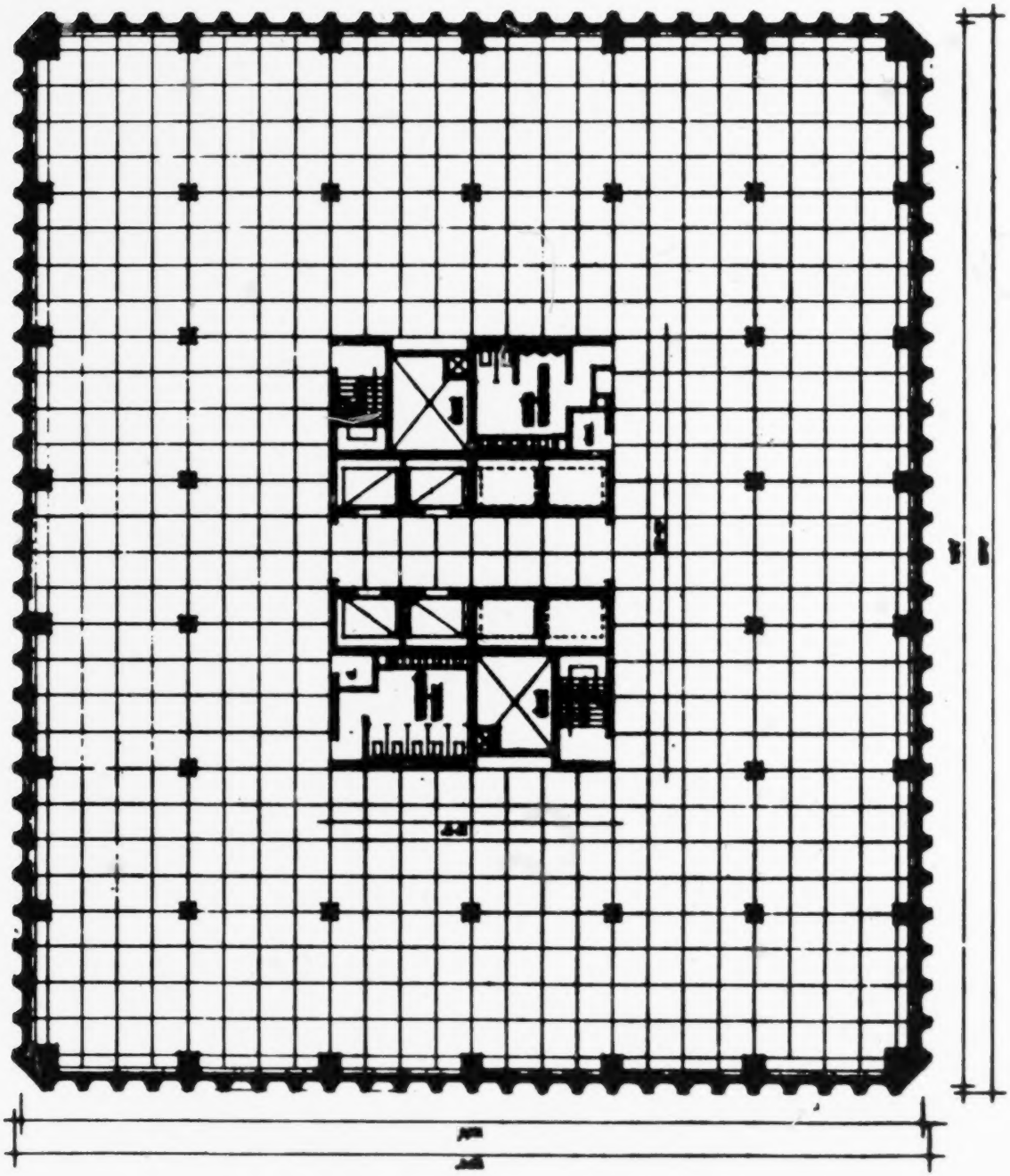
Architects: Craig & Kohler, Ottawa
General Contractor: Owner Built



ALBERT STREET ELEVATION

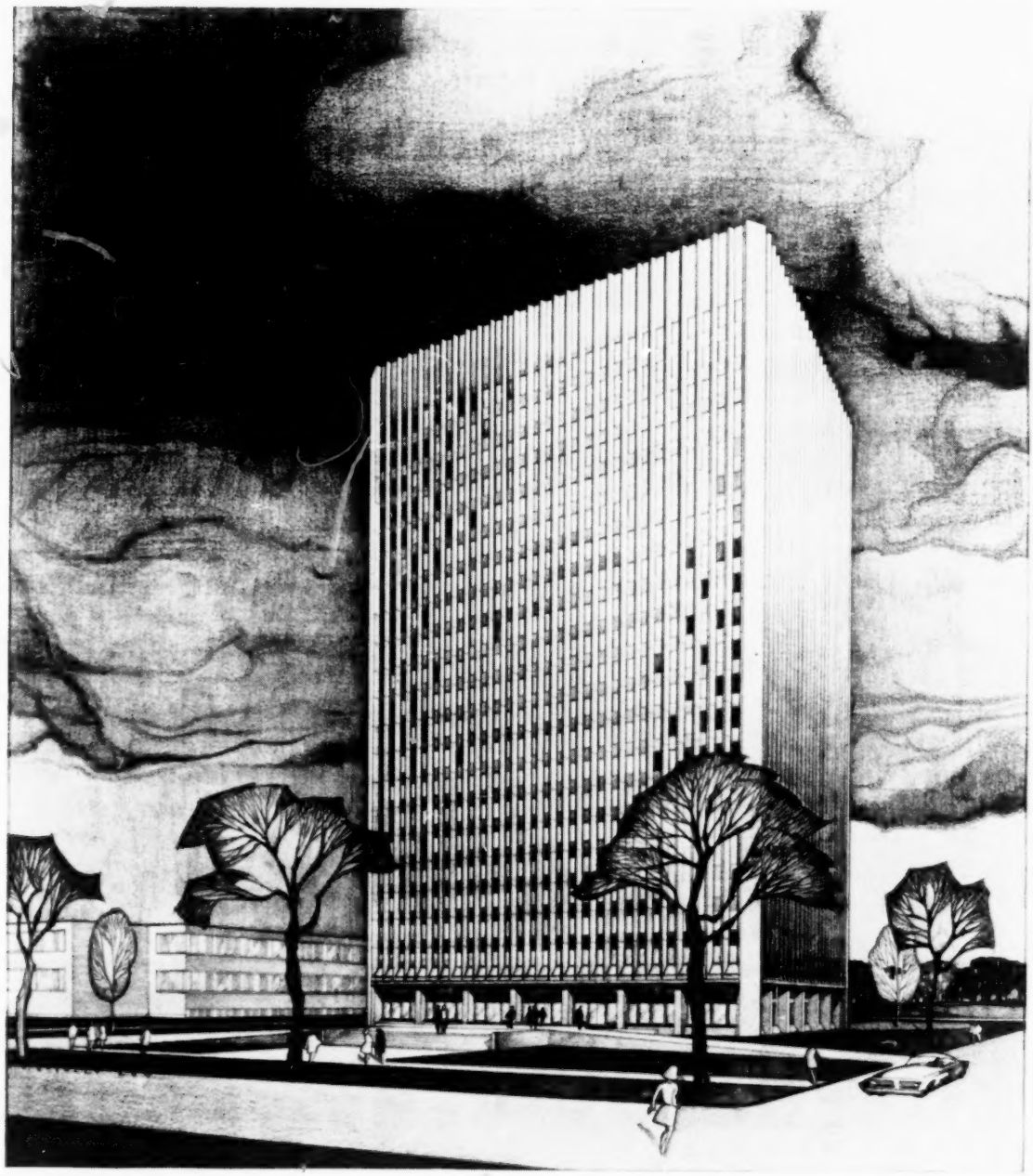
Varette Office Building, Ottawa

Architects: Craig & Kohler, Ottawa
General Contractor: Owner Built



General Purpose Office Building, Ottawa

Architects: Ronald Ogilvie, Ottawa
General Contractor: Argo Construction Ltd., Montreal



General Purpose Office Building, Ottawa

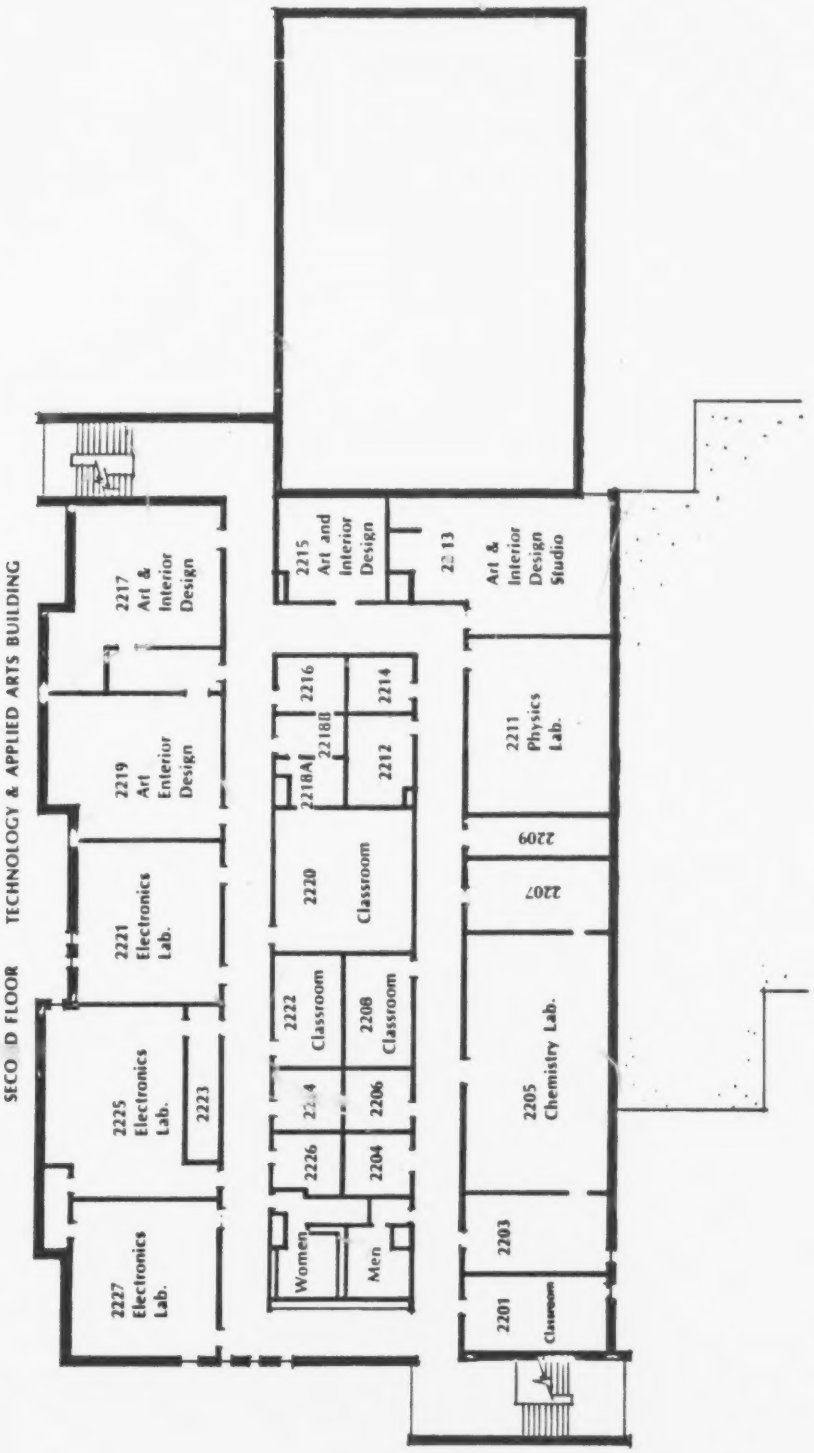
Architect: Ronald Ogilvie, Ottawa
General Contractor: Argo Construction Ltd., Montreal

Food & Drug Laboratory, Toronto

Architects: Department of Public Works, Ottawa
Robbie, Vaughan & Williams, Toronto
General Contractor: West York Construction Ltd., Toronto

Food & Drug Laboratory, Toronto

Architects: Department of Public Works, Ottawa
Robbie, Vaughan & Williams, Toronto
General Contractor: West York Construction Ltd., Toronto



Georgian College of Applied Arts and Technology, Phase IIIA, Barrie

Architects: Page & Steele, Toronto
Salter & Allison, Barrie
General Contractor: M & D Kennedy Contractors Limited, Barrie

Georgian College of Applied Arts and Technology, Phase IIIA, Barrie

Architects: Page & Steele, Toronto
Salter & Allison, Barrie
General Contractor: M & D Kennedy Contractors Limited, Barrie

BUILDING AREAS, VOLUMES AND TOTAL COSTS

TABLE 1

University Buildings	Area/GSF	Volume (CF.)	1971 Cost (incl. Federal Sales Tax)
Child Study Center	58,150	670,000	1,954,360
Law Building	85,140	1,214,843	2,371,080
Crop Science Building	106,069	1,415,760	4.496,050
Petrie Science Building	131,000	1,639,620	4,551,370
Math & Computer Building	299,736	3,825,000	7,258,520
Engineering IV	170,900	2,505,000	6,289,300
Non-University Buildings			
Northern Electric Laboratory	90,147	1,329,125	2,175,800
Systems Dimensions Limited Building	102,930	1,407,220	2,314,030
Varette Office Building	317,400	3,293,753	4,675,990
General Purpose Office Building	433,410	4,848,413	7,440,480
Food & Drug Laboratory	105,675	1,327,832	3,385,900
Georgian CAAT (IIIA)	43,140	621,440	1,032,260
	1,943,697	24,098,006	$47,945,140

NOTE: All costs normalized to Toronto, last quarter, 1971

TABLE 2

BUILDING UNIT COSTS

(Highest costs underlined. Lowest costs underlined.)

University Buildings	Cost/ GSF	Rank	Cost/ NASF	Rank	Cost/ CF
Child Study Center	$33.61	4	$54.28	2	$2.92
Law Building	27.85	6	45.33	6	1.95
Crop Science Building	42.39	1	71.27	1	3.18
Petrie Science Building	34.74	3	60.92	3	2.78
Maths & Computer Building	24.26	7	38.38	7	1.90
Engineering IV	36.80	2	62.33	5	2.52
Non-University Buildings					
Northern Electric Laboratory	24.14	8	32.56	9	1.64
Systems Dimensions Limited Building	22.58	10	29.17	10	1.64
Varette Office Building	14.73	12	*	12	1.42
General Purpose Office Building	17.17	11	*	11	1.53
Food & Drug Laboratory	32.04	5	62.86	4	2.55
Georgian CAAT (IIIA)	23.93	9	34.17	8	1.66

NOTE: Federal tax rebate not deducted from University Projects costs.
All costs normalized to Toronto, last quarter 1971

* NASF figures not applicable: see Section 6c for explanation

COSTS BY BUILDING ELEMENT. (Dollars/GSF and Percentages of Total Cost.)

(Highest costs underlined. Lowest costs underlined)

	Overall Cost	1. Indirect & General	%	2. Sub-structure	%	3. Horizontal Structure	%	4. Exterior Cladding	%	5. Interior Vertical	%	6. Multi-storey Elements	%
University Buildings													
Child Study Center	4	3.04	9.0	1.02	3.0	3.84	11.5	6.00	17.8	2.30	6.8	1.39	4.2
Law Building	6	2.53	9.1	1.20	4.3	6.03	21.6	3.35	12.0	1.94	7.0	0.81	2.9
Crop Science Building	1	3.61	8.5	1.47	3.5	5.88	13.9	3.98	9.4	1.84	4.3	0.67	1.6
Petrie Science Building	3	2.95	8.5	0.43	1.2	4.75	13.7	3.75	10.8	2.73	7.9	0.80	2.3
Maths & Computer Building	8	2.20	9.1	0.79	3.3	4.25	17.5	3.11	12.8	2.08	8.6	0.77	3.1
Engineering IV	2	2.75	7.5	1.49	4.0	6.01	16.3	4.88	13.3	2.62	7.1	0.59	1.6
Non-University Buildings													
Northern Electric Laboratory	9	1.77	7.3	0.52	2.1	4.43	18.4	2.18	9.0	1.07	4.4	0.26	1.1
Systems Dimensions Ltd. Building	10	1.76	7.8	0.24	1.1	3.94	17.5	2.22	9.9	1.39	6.2	0.55	2.4
Varette Office Building	12	1.06	7.2	0.32	2.2	2.03	13.8	2.19	14.9	0.70	4.8	1.63	11.0
General Purpose Office Building	11	1.13	6.6	0.12	0.7	2.38	14.0	3.06	17.8	0.80	4.6	1.77	10.3
Food & Drug Laboratory	5	1.83	5.7	0.79	2.4	3.50	11.0	2.88	9.0	1.59	5.0	0.54	1.7
Georgian CAAT (IIIA)	7	1.76	7.4	0.54	2.2	3.96	16.6	3.11	13.0	1.97	8.2	0.23	0.9

TABLE 3

	7. Interior Finishes	%	8. Fittings & Fixtures	%	9. Cash Allow	%	10. Plumbing & Drains	%	11. HVAC	%	12. Electrical	%
University Buildings												
Child Study Center	3.13	9.3	0.99	3.0	0.89	2.6	1.92	5.7	4.90	14.6	4.18	12.5
Law Building	2.72	9.8	0.77	2.8	0.44	1.6	0.72	2.6	4.50	16.2	2.84	10.1
Crop Science Building	2.06	4.9	3.31	7.8	0.39	0.9	2.64	6.2	9.86	23.2	6.68	15.8
Petrie Science Building	1.47	4.2	4.28	12.3	0.57	1.6	2.11	6.1	6.33	18.2	4.57	13.2
Maths & Computer Building	1.78	7.3	0.78	3.2	0.60	2.5	0.91	3.8	3.84	15.8	3.15	13.0
Engineering IV	1.96	7.3	3.01	8.2	0.65	1.8	1.84	5.0	6.14	16.7	4.86	13.2
Non-University Buildings												
Northern Electric Laboratory	2.48	10.3	0.30	1.2	0.15	0.6	1.20	5.0	6.00	24.9	3.78	15.7
Systems Dimensions Ltd. Building	1.93	8.5	1.02	4.5	0.26	1.1	0.83	3.7	5.34	23.6	3.10	13.7
Varette Office Building	1.83	12.4	0.10	0.7	0.05	0.3	0.76	5.2	2.70	18.3	1.36	9.2
General Purpose Office Bldg.	1.67	9.7	0.07	0.4	0.03	0.2	0.81	4.7	2.88	16.8	2.45	14.2
Food & Drug Laboratory	1.24	3.8	3.68	11.5	0.39	1.2	3.36	10.5	7.76	24.2	4.48	14.0
Georgian CAAT (IIIA)	2.08	8.7	1.01	4.2	0.48	1.9	1.68	7.0	3.08	12.9	4.03	16.9

TABLE 3

Note: Federal tax rebate not deducted from University Projects Costs
All costs normalized to Toronto, last quarter 1971

3. FINDINGS

Introduction

This study provides some clear and expressive information as to where the costs of building lie. In addition to elemental building costs information is provided on the nature of the design, construction, and composition of each element, and on the performance both of the building as a whole and of some of its elements. In order to budget and control costs for any building program, it is necessary to investigate the probable costs associated with the defined purpose of the building. Such investigation is in fact done, to some extent, during the budgeting, programming and design of any new building. The information presented here may make such single building studies more effective and more pointed and may also be used to enable campuses to set up guidelines or even cost targets related to certain building elements to which the architect and the engineer can respond.

Such information enables cost estimates to be put on factors which, although well known in general, can typically only be discussed across a conference table in terms of general assertions. The more information of the kind shown in this report is gathered, the more effective will become the questions that may be asked, and the trade-off studies that can be done.

Cost control is dependent upon an information base of consistent comparative information. This information must be available in sufficient detail to provide a basis for measuring the effectiveness of design alternatives. This study provides the methodology for such a data base, and also utilizes a sample large enough to reveal the effectiveness of such coherent comparative data.

a. Based on this sample, where university and non-university buildings have approximately like functions, mixes of space, and are similar in size, their costs were found to be comparable.

Compare, for example, the Mathematics and Computer Building, the Systems Dimensions Limited Building, and the Northern Electric Laboratory Building:

	GSF	Cost/GSF	Cost/NASF	Lab, Support and Data Process Space
Mathematics and Computer Building	299,736	24.26	38.38	22.7%
Systems Dimensions Limited Building	90,147	24.14	29.17*	33.6%
Northern Electric Lab Building	102,930	22.58	32.56*	17.8%

*Both the Systems Dimensions Limited and Northern Electric Laboratory buildings have NASF/GSF ratios which, as discussed in section 6c, are not comparable to university buildings.

Compare also the Petrie Science Building and the Food and Drug Laboratory:

	GSF	Cost/GSF	Cost/NASF	Lab, Support and Data Process Space
Petrie Science Building	131,000	34.74	60.92	70.2%
Food and Drug Laboratory	105,675	32.04	62.86	51.0%

A detailed comparison of these groups of buildings is presented in section 4.

b. The cheapest buildings within the range studied were ones that were very large, very repetitive, very simple in plan form, and responded to a single generalized function, such as the provision of undifferentiated office space.

This is a kind of building which, typically, the university does not build. It does not build very large buildings because of the growth pattern on campuses and related funding. It does not build single-function buildings, offices, and laboratories. Very often for programmatic reasons these spaces adjoin on the same floor, or are contained within the same building. For example:

	GSF	Cost/GSF	Floors above grade	Office space
General Purpose Office Building	433,410	17.17	22	92%*
Varette Office Building	317,400	14.73	19	78%*

Compare these two buildings with a lightly serviced university building, the Law Building:

	GSF	Cost/GSF	Floors above grade
Law Building	85,140	27.85	2

	Special	Office Space	Classroom	Library
Law Building	11.8%	16.7%	16.5%	50.1%

A detailed comparison of these buildings is presented in section 4.

---

* These figures do not allow for circulation space within the office areas: the net assignable figure is not available.

c. The combination of shell and service costs effectively decides the cost magnitude of the building. High costs in these two groups of elements cannot be offset by low costs elsewhere.

In the sample, the shell accounted for between 22.4% and 37.9% of the total cost of the building. The services accounted for between 21.8% and 34.5%. In combination, these two groups of elements account for between 44.2% and 72.4% of the total building cost.

	Shell & Services Cost/GSF	Rank	Building Cost/GSF	Rank
University Buildings				
Child Study Center	23.84	3	33.61	4
Law Building	20.33	6	27.85	6
Crop Science Building	31.64	1	42.39	1
Petrie Science Building	23.40	4	34.74	3
Mathematics and Computer Building	17.51	9	24.26	7
Engineering IV	27.10	2	36.80	2
Non-University Buildings				
Northern Electric Laboratory	19.44	7	24.14	8
Systems Dimensions Limited Building	16.89	10	22.58	10
Varette Office Building	9.98	12	14.73	12
General Purpose Office Building	12.47	11	17.17	11
Food and Drug Laboratory	23.27	5	32.04	5
Georgian CAAT (IIIA)	17.92	8	23.93	9

In this sample, a comparison of rank between the cost of Shell and Services/GSF and Building Cost/GSF showed only one instance of a two-point difference, and three instances of a one-point difference. The remaining ranks are identical.

The costs of the shell for university buildings ranged from $8.89/GSF to $13.30/GSF. For non-university buildings, the range was from $4.82/GSF to $8.31/GSF.

Services are predominantly the result of functional and programmatic requirements within the building. If certain kinds of research are to be performed in the building, certain kinds of services will be essential, and there is no escaping their cost. Shell costs, on the other hand, are relatively independent of program, which suggests that an effective way to attack costs, and at the same time have minimal effect on program functions, is to tackle the shell cost of the building. This point is developed further in the recommendations section. The costs of the exterior skin are also affected by the External Wall/GSF ratio; a simple plan form such as the General Purpose Office Building, with an Exterior Wall/GSF ratio of 0.31, can be compared to Engineering IV at 0.79. Thus Engineering IV has more than twice the perimeter wall/GSF.

Shell costs are the summation of costs for elements 2, 3 and 4, plus a percentage of element 1. Services costs are the summation of costs for elements 10, 11 and 12, plus a percentage of element 1.

d. The cost of services varies more than the cost of the shell, and it is also a high cost element; hence it may exert more influence on the overall cost of the building than the shell; shell costs vary over a range of 3:1, while services costs vary over a range of 4:1.

One university building, the Crop Science Building, had service costs of $20.81/GSF, or 140% of the entire cost of the Varette Building ($14.73/GSF). These high service costs relate directly to the function of the building, i.e. advanced research, requiring special environmental conditions. For example, the Crop Science Building has large areas with 1500 foot-candle intensity lighting for plant growth experiments. In addition, the service costs include items that in another type of building might be costed as movable equipment, and hence not appear in this analysis.

However, in one sample building, the Food and Drug Laboratory, a very high service cost was counterbalanced by a very low shell cost and, in conjunction with average costs for other elements, resulted in an average cost for the building.

Comparison HVAC Element:

	Tons Cooling/1000 GSF	%AC	CFM/GSF	BTU/HR/GSF
Crop Science Building	5.7	100	2.43	102.4
Varette Office Building	1.58	67	0.41	26.4

e. The cost of interior finishes of walls, floor and ceiling, has minimal effect on the overall cost of the building.

The building with the lowest-cost interior finishes in the study, the Food and Drug Laboratory, ranked fifth in overall placing. The building with the highest-cost interior finishes ranked fourth in overall cost. The highest-cost building ranked fifth in interior finishes cost, and the lowest-cost building ranked seventh.

This finding is of particular interest because it contradicts a popular impression of cost influence. The lay observer, seeing expensive wall or ceiling finishes, doors, paneling and the like, will often equate this with an expensive building. The study shows conclusively that this is not so.

The interior finishes element becomes complex to study when the variables of floor, ceiling, walls and special finishes are considered and related to intensity of use. This is particularly true as far as interior wall finishes are concerned, since the relative quantity of interior walls in the study varies from building to building, over a range of about 3:1. This

suggests that careful trade-off studies relating long-term maintenance costs to relative quantities of various materials are desirable; nevertheless, the general conclusion holds that the overall cost of finishes will have little effect on the overall cost of the building. This conclusion has a very important corollary, namely, that money spent in this element to reduce maintenance costs is money very well spent indeed, because relatively expensive low-maintenance materials will still have little inflationary effect on the overall cost of the building.

This is particularly important as a high proportion of the maintenance dollar is spent on cleaning, repairing and replacing interior finish materials.

f. This is a great variation in fixtures and fittings cost. This variation is a direct result of the functions of the building. It is also related to the method by which these items are procured, i.e., whether this figure shows in the building contract (and the drawings and specifications) or not.

The variation in fixtures and fittings cost was from $0.07/GSF for the General Purpose Office Building to $4.28/GSF for the Petrie Science Building.

Typically, university buildings have high figures, especially in labs. Note, however, that the Food and Drug Laboratory has a high figure ($3.68/GSF) where Northern Electric Laboratory has a low one ($0.30/GSF). Obviously, Northern Electric Laboratory fixtures and fittings cost does not show in this analysis, and so it is not comparable to the other buildings in this respect.

g. Indirect costs of university buildings in this sample average $1.19/GSF greater than non-university buildings.

This element includes the general contractor's indirect and general expenses for items such as access to site, site accommodation, site protection, temporary services, clean-up, supervision, insurance and bonds, equipment and winter conditions, together with the contractor's fee, which represents a proportion of his head office overheads and his profit. Estimating these indirect costs is largely judgmental being directly related for the most part to the following factors:

(a) The estimated time necessary (or available) for construction.
(b) The estimated cost of the project.
(c) The nature, complexity and quality of the work.
(d) The anticipated level of supervision and administration to be exercised by the client and his consultants.

(e) Other intangible factors, such as the level of the market, anticipated competition, time of year, quality of tendering documentation, time allowed for tendering, payment procedures, change order approval procedures, etc.

However, the estimates in this report assume a consistent level of market, competition and time of year, being normalized to Toronto, last quarter, 1971.

It should be further noted in relation to this element that bids are not attempts at accurate estimating, they are attempts to obtain the contract at the highest possible price, resulting (naturally) in the highest possible profit.

The following table lists the comparative elemental costs and percentages of total cost for this element:

	Indirect & General Expenses		Percentage of Total Cost	
University Buildings	Cost/GSF	Rank	%	Rank
Child Study Center	3.04	2	9.0	3
Law Building	2.53	4	9.1	1
Crop Science Building	3.61	1	8.5	4
Petrie Science Building	2.95	3	8.5	4
Mathematics and Computer Building	2.20	5	9.1	1
Engineering IV	2.15	6	7.5	7
Non-University Buildings				
Northern Electric Laboratory	1.77	8	7.3	9
Systems Dimensions Limited Building	1.76	9	7.8	6
Varette Office Building	1.06	12	7.2	10
General Purpose Office Building	1.13	11	6.6	11
Food & Drug Laboratory	1.83	7	5.7	12
Georgian CAAT (IIIA)	1.76	9	7.4	8

As the cost of all other elements influences its level of cost, the cost per GSF is not the most meaningful basis of comparison for this element. An analysis of indirect costs expressed as a percentage of the whole reveals the average percentage for university buildings at 8.6% and for the non-university buildings at 7.0%.

Whilst further study in this area appears warranted, it would seem that the reasons for this higher proportion can be attributed to the factors listed above, i.e. university buildings generally take longer to build; the buildings in the sample group are of a higher unit cost; they tend to be more complex and contain more items of work of a higher quality; they are intended to have a considerably longer life; hence universities as owner-occupiers as well as their design consultants tend to insist on specifications being met and institute rigorous inspection routines to ensure this. The effect of this latter consideration on contractors' prices should not be underestimated.

It would be interesting and profitable to study the effect of the increasing use of construction management techniques by the universities since it seems likely that such techniques may well result in a reduction of indirect expenses.

h. The overall cost of buildings is not consistent with the cost of their individual elements. A low-cost building may contain some elements that are high in cost and conversely, a high-cost building may have some low-cost elements within it.

For example, the Food and Drug Laboratory ranked 5 overall, but 10 in shell cost, 2 in services, and 2 in fixtures and fittings. Note that the Varette Office Building ranked 12 overall, but 2 in multi-storey elements. The Crop Science Building ranked 1 overall, but 7 in interior vertical elements.

However, interpretation of the relative costs of elements may be complex. An example of this complexity of interpretation shows in the General Purpose Office Building, ranking 11 at a figure of $17.17/GSF. This building had a cost for exterior cladding of $3.06/GSF which is 8 in rank. However, the unit cost of its exterior pre-cast wall was $10.61/square foot: approximately double the unit cost of any other exterior walls in the study. The Exterior Wall/GSF ratio in this building was .31, the lowest figure of any in the study. This ratio shows the amount of the perimeter wall per gross square foot of building, and since this building is nearly square in plan, with no projections or recesses, its relatively small amount of exterior wall can counterbalance the high unit costs of the wall itself.

It should also be noted that elements are related to one another through the design of a building. It is not, for example, possible to combine all the low-cost elements in a single building (resulting, for this study, in a hypothetical building costing $12.46/GSF). Such a building would be a high-rise building with no elevators!

i. There is a wider range of element costs than building costs. This finding confirms the need to look closely at element costs in order to gain understanding of cost characteristics of the building.

For the buildings studied, overall costs range from $42.39/GSF to $14.73/GSF, or 3:1, while building elements range from 7:1 (Multi-storey elements) to 6:1 (Fittings and Fixtures).

j. Higher performance requirements cost more, and the study shows the magnitude of some of these costs, as well as the complexity of the variables that influence the cost/design relationship.

For example, the study demonstrates that high-cost HVAC systems are the result of requirements for high-capacity HVAC systems. A clear measure of this shows in the Crop Science Building, with its special environmental requirements for plant growth research, which provides 5.7 tons of cooling per thousand gross square feet, 102.4 BTU per hour heating per gross square foot, and 2.43 CFM of ventilation per square foot at a cost of $9.86/GSF. This compares with another university science building, the Petrie Science Building, which provides 4.2 tons of cooling per thousand gross square feet, 61 BTU per hour heating per gross square foot, and 1.00 CFM ventilation per square foot, at a cost of $6.33/GSF.

Clearly, the functions and programs in these buildings make many more demands on the HVAC system than in that of a single-function office building such as Varette. This building provides 1.58 tons of cooling per thousand square feet, 26.4 BTU per hour heating per gross square foot, and .41 CFM of ventilation per square foot, for a cost of $2.69/GSF, the lowest-cost HVAC system in the sample. In addition, in this building only 67% of the space is air-conditioned, while the other two buildings are fully air-conditioned.

This comparison shows the consistency between the cost of an HVAC system and its capacity, i.e., the quantity of air-conditioned and heated space that it provides relative to a standard measure, such as a gross square foot.

Capacity required is also affected by the volume of space heated. Buildings in the study ranged in average floor-to-floor height from 10.33 feet (Varette Office Building) to 14.66 feet (Engineering IV). Thus, the effect of volume on the buildings in this study is much less than the effect of program-related requirements. However, a study of operational costs of HVAC systems would be necessary to validate this statement.

This example also shows clearly that the comparison, even of a single building element, let alone a whole building, is not a simple procedure, and comparing the costs of air-conditioning on only a gross square footage basis is not going to provide a valid comparison unless functional demands are also considered. Finally, it must be emphasized that this study cannot validate the need for these differences in capacity; it can only point out that they exist.

k. University buildings generally cost more because of a conscious attempt to provide good exterior quality and a university identity; this extra cost for the sample of buildings lies in the range of $1.10 to $1.73/SF.

An attempt to isolate the costs of exterior quality for a university building was made as follows. One can assume that the extra cost is in that part of the shell that is above ground. This is contained in Element 4, Exterior Cladding; comprising 4b, Walls Above Grade; 4c, Windows; 4d, Exterior Doors; 4e, Projections, Balconies, etc. Adding to these element subcosts a figure representing that portion of the indirect costs (Element 1) attributable to Exterior Cladding (obtained by multiplying the indirect cost element by the percentage of exterior cost element of the whole), provides the basis for the figures shown below.

If unit prices for Exterior Cladding/SF are compared, so that the perimeter/GSF ratio is considered, the differences between university and non-university buildings are as follows:

University Buildings	Exterior Cladding Unit Cost/SF
Child Study Center	5.84
Law Building	3.35
Crop Science Building	3.21
Petrie Science Building	3.10
Maths & Computer Building	3.34
Engineering IV	4.89
Non-University Buildings	
Northern Electric Laboratory	2.31
Systems Dimensions Limited	1.71
Varette Office Building	2.05
General Purpose Office Building	2.96
Food & Drug Laboratory	2.48
Georgian CAAT (IIIA)	3.24

Eliminating the three largest buildings (viz the Mathematics & Computer Building, the Varette Office Building, and the General Purpose Office Building) in order to lessen the cost reduction effects of scale, then average costs for above-ground exterior cladding are:

University Buildings	$4.13/SF
Non-University Buildings	$2.40/SF
Difference	$1.73/SF

This figure gives a measure of the maximum unit cost difference which, in this sample of buildings, could be attributed to visible exterior cladding of higher quality.

If unit prices are compared (so that the effect of perimeter/GSF ratio does not apply), the differences between university and non-university buildings are as follows:

	Exterior Cladding Unit Cost/ Wall Area Above Grade	$/SF of Window	% Window	Weighted Average
University Buildings				
Child Study Center	5.04	12.29	12.0	5.91
Law Building	4.55	12.84	25.0	6.62
Crop Science Building	4.95	10.50	15.0	5.78
Petrie Science Building	4.62	14.11	10.0	5.57
Maths & Computer Building	4.72	7.82	11.0	5.06
Engineering IV	5.14	11.00	16.5	6.11
Non-University Buildings				
Northern Electric Laboratory	4.23	12.00	10.7	5.06
Systems Dimensions Limited	2.14	10.44	14.0	3.30
Varette Office Building	6.52	4.75	16.0	6.24
General Purpose Office Building	10.61	7.80	38.0	9.54
Food and Drug Laboratory	4.78	9.53	29.0	6.16
Georgian CAAT (IIIA)	4.83	13.44	6.4	5.38

Omitting the three largest buildings (viz the Mathematics & Computer Building, the Varette Office Building, and the General Purpose Office Building) in order to lessen the cost reduction effects of scale, then average costs for above ground Exterior Cladding are:

University Buildings	$6.06/ SF
Non-University Buildings	$4.96/ SF
Difference	$1.10/ SF

This figure gives a measure of the minimum unit cost difference which, in this sample of buildings, could be attributed to visible exterior cladding of higher quality.

It should also be noted that this quality is not only a matter of appearance, but may have great impact on operating and long-term maintenance costs, particularly in the case of the quality of window types and glazing. The proposed Phase II study would provide information on the magnitude of such savings.

4. DETAILED SAMPLE STUDIES

A full understanding of building cost and performance can only be gained by detailed study of consistent and comparable information.

The section which follows compares a number of buildings in detail and, where significant, points out parameters of cost and performance. This kind of comparison is individual rather than statistical. The comparisons that follow are between not more than three buildings chosen because of their general similarities, either in cost, function, performance, a combination thereof. Therefore, great care should be exercised in interpreting and extrapolating these results. To obtain statistically valid results would have necessitated an analysis of many more buildings than are contained in our sample. It goes without saying that neither the time nor the resources available to the Task Force permitted this. Therefore we have attempted to compensate for this deficiency by ranking a larger sample of buildings and chosing the 25th, 50th, and 75th percentile buildings from each group for more detailed analysis. The comparisons show that

1. Buildings can be similar in overall cost, but vary considerably in elemental costs - see the Petrie Science Building and the Food and Drug Laboratory comparison.

2. Buildings can be superficially similar in function but vary considerably in space and service allocation - see the Maths and Computer Building, the Systems Dimensions Limited Building, and the Northern Electric Laboratory Building comparison.

3. Buildings can be similar in overall performance, but vary considerably in detailed performance of certain elements - see the Law Building, the General Purpose Office Building and the Varette Office Building comparison.

a. Comparison of the Petrie Science Building and the Food and Drug Laboratory

These two buildings have similar mixes of space and are very close in size and cost. Both are heavily serviced buildings.

Petrie Science Building cost $34.74/GSF as against Food and Drug Laboratory's cost of $32.04/GSF. A more favourable NASF/GSF ratio for Petrie (0.57 vs 0.51) results in a reversal of ranking for NASF unit cost ($60.32/NASF for Petrie, and $62.86/NASF for Food and Drug).

The shell cost of the Petrie Science Building is $2.57/GSF more than that for the Food and Drug Laboratory, but this is offset by a service cost which is $2.44/GSF less, divided about equally between plumbing and HVAC. Petrie, however, provides about 25% more cooling capacity and 4% more ventilation capacity while the Food and Drug Laboratory provides approximately 85% more heating capacity.

COMPARISON OF THE PETRIE SCIENCE BUILDING AND THE FOOD AND DRUG LABORATORY

	Cost/ GSF	Cost/ NASF	GSF	NASF/GSF Ratio	Volume/ GSF	Exterior Cladding/ GSF	Roof Area/ GSF	Floors above grade	Floors below grade
Petrie Science Building	34.74	60.92	131,000	0.57	12.51	0.51	0.24	3	1
Food & Drug Laboratory	32.04	62.86	105,675	0.51	12.57	0.54	0.23	3	1

PERCENTAGE DISTRIBUTION OF NASF BY FUNCTION

	Classroom	Special Purpose	Office	Library	Special Use	General Use	Support
Petrie Science Building	2.2	51.1	21.9	1.4	2.0	2.3	19.1
Food & Drug Laboratory	---	31.6	39.5	3.0	1.9	3.8	20.2

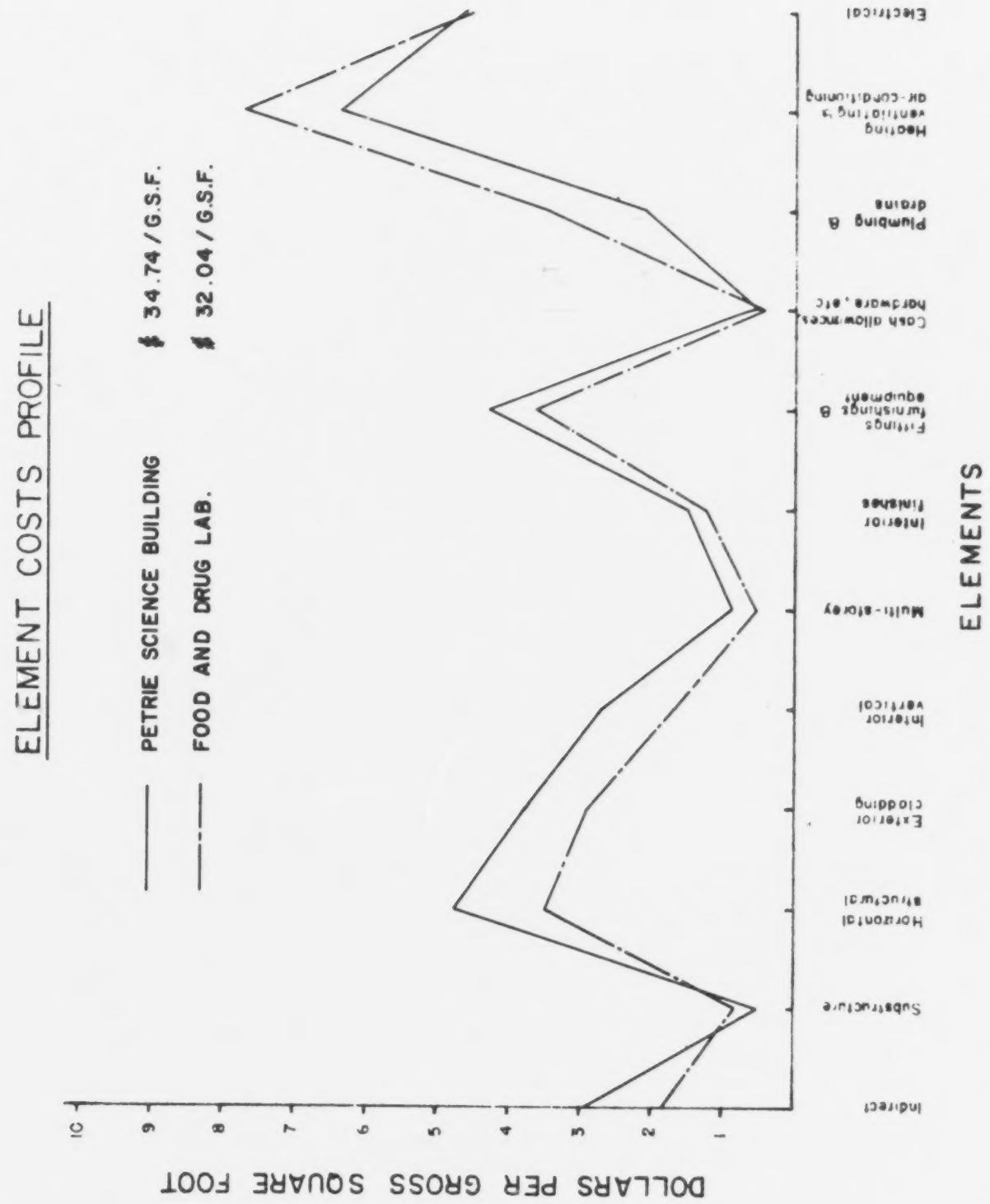
ELEMENT COSTS PER GSF

	Cost/ GSF	1	2	3	4	5	6	7	8	9	10	11	12
Petrie Science Building	34.74	2.95	0.43	4.75	3.75	2.73	0.80	1.47	4.28	0.57	2.11	6.33	4.57
Food & Drug Laboratory	32.04	1.83	0.79	3.50	2.88	1.59	0.54	1.24	3.68	0.39	3.36	7.76	4.48

1: Indirect & General Expenses; 2: Substructure; 3: Horizontal Structure; 4: Exterior Cladding; 5:Interior Vertical; 6: Multi-storey; 7: Interior Finishes; 8: Fittings & Fixtures; 9: Cash Allowances; 10: Plumbing; 11: HVAC; 12: Electrical.

HVAC

	Tons/ 1000 GSF	CFM/ GSF	BTU/ HR/ GSF	Shell Cost	Services Cost	Unit Cost of Exterior Walls	Cost/GSF of Ext. Wall	Ratio Ext./ GSF	Unit Cost of Int. Vert. Partitions	Cost/ CSF of Interior Vert.	Ratio of Int. Vertical/ GSF
Petrie Science Building	4.42	1.00	61.0	9.35	14.05	4.62	1.52	0.57	2.23	2.15	1:10.8
Food & Drug Laboratory	3.50	.96	110.0	6.78	16.49	4.78	1.48	0.54	1.57	1.02	1:14.5


ELEMENT COSTS PROFILE
PETRIE SCIENCE BUILDING $ 34.74 / G.S.F.
FOOD AND DRUG LAB. $ 32.04 / G.S.F.
DOLLARS PER GROSS SQUARE FOOT
1
2
3
4
5
6
7
8
9
10
ELEMENTS
Indirect
Substructure
Horizontal structural
Exterior cladding
Interior vertical
Multi-storey
Interior finishes
Fittings furnishings & equipment
Cash allowances hardware, etc
Plumbing & drains
Heating ventilating & air-conditioning
Electrical

The extra cost of the Petrie Science Building of $2.70/GSF is predominantly made up of Indirect Costs ($1.12/GSF), Fittings and Fixtures ($0.60/GSF), and Interior Vertical elements ($1.14/GSF). In addition, the Petrie Science Building has an extra cost of $0.44 for roof finish, occasioned by requirements for a high quality roof which is used functionally for experimental purposes.

The extra cost for the Petrie Science Building in interior vertical elements is a combination of material (Petrie - 29% structural concrete, 68% concrete block; Food and Drug Laboratory - 69% concrete block, 11% drywall and studs, 4% brick), and a partition ratio which provides approximately 50% more partitions/GSF.

The extra cost for the Petrie Science Building in fittings and fixtures is probably accounted for by additional instructional material not provided in the Food and Drug Laboratory (chalk and tackboards, floating floor, etc.).

b. Comparison of the Law Building, the General Purpose Office Building, and the Varette Building

This summary compares a lightly serviced university building (the Law Building) with a speculative high-rise office building (the Varette Office Building) and a high-rise government office building that was specifically designed as a prototype low-cost building (the General Purpose Office Building).

The Law Building cost $27.85/GSF as against the General Prupose Office cost of $17.17/GSF, and the Varette cost of $14.73/GSF. Since both office buildings provide no partition layout for analysis, it is not possible to obtain a realistic assignable square-foot figure for them, so that the NASF comparison is not presented.

The shell cost for the Law Building of $11.54/GSF compares with shell costs of $5.93 (General Purpose Office Building) and $4.82 (Varette Office Building). This large discrepancy is primarily the result of large areas, and a simple repetitive plan that optimizes all structural and skin construction costs in the office buildings. The exterior skin is minimal in area relative to the plan (the relevant Exterior Cladding/GSF ratios are General Purpose Office 0.31, Varette 0.37, and Law 0.50) and very simple, with uniform height per floor, no re-entrant corners, and minimal special detailing. Floor loadings for the office buildings are low (General Purpose 75 lb/SF, Varette 50 lb/SF) as against the Law Building's average of 125 lb/SF.

The complex plan form and high loadings of the Law Building result in the highest horizontal structural cost for the entire sample of twelve buildings studies.

Service costs for the Law Building are not noticeably higher, but not to the same extent as the shell. Performance in HVAC is noticeably higher for the Law Building also.

COMPARISON OF THE LAW BUILDING, THE GENERAL PURPOSE OFFICE BUILDING, AND THE VARETTE OFFICE BUILDING

	Cost/ GSF	Cost/ NASF	GSF	NASF/GSF Ratio	Volume/ GSF	Exterior Cladding/ GSF	Roof Area/ GSF	Floors above grade	Floors below grade
Law Building	27.85	45.53	85,140	0.59	14.27	0.50	0.50	2	1
General Purpose Office Bldg	17.17	19.96	433,410	0.86	11.19	0.31	0.04	22	1
Varette Office Bldg.	14.73	16.66	317,400	0.89	10.38	0.37	0.05	19	4

PERCENTAGE DISTRIBUTION OF NASF BY FUNCTION

	Classroom	Special Purpose	Office	Library	Special Use	General Use	Support	Parking
Law Building	16.5	11.8	16.7	50.1	--	4.9	--	--
General Purpose Office Bldg.	--	--	78.0	--	--	--	--	22.0
Varette	--	--	92.5	--	--	7.5	--	--

ELEMENT COSTS PER GSF

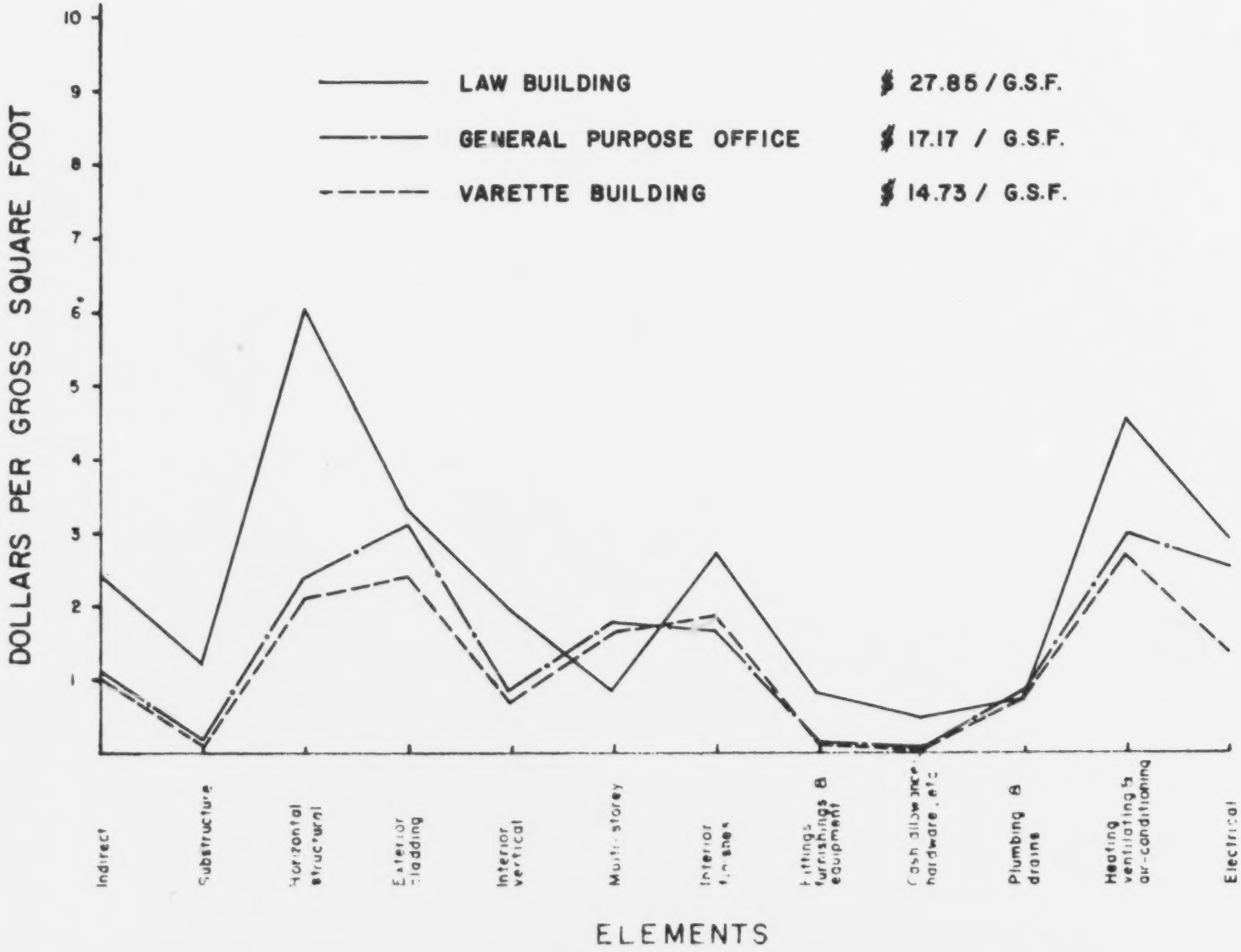
	Cost/ GSF	Cost/ NASF	1	2	3	4	5	6	7	8	9	10	11	12
Law Building	27.85	45.53	2.53	1.20	6.03	3.35	1.94	0.81	2.72	0.77	0.44	0.72	4.50	2.84
General Purpose Office Bldg.	17.17	19.96	1.13	0.12	2.38	3.06	0.80	1.77	1.67	0.07	0.03	0.81	2.88	2.45
Varette Office Bldg.	14.73	16.66	1.06	0.32	2.03	2.19	0.70	1.63	1.83	0.10	0.05	0.76	2.70	1.36

1: Indirect & General Expenses; 2: Substructure; 3: Horizontal Structure; 4: Exterior Cladding; 5: Interior Vertical 6: Multi-storey; 7: Interior Finishes; 8: Fittings & Fixtures; 9: Cash Allowance; 10: Plumbing; 11: HVAC; 12: Electrical.

HVAC

	Tons/ 1000 GSF	CFM/ GSF	BTU/ HR/ GSF	Shell Cost	Services Cost	Unit Cost of Exterior Walls	Cost/GSF of Ext. Wall	Ratio Ext./ GSF	Unit Cost of Int. Vert. Partitions	Cost/ GSF of Interior Vertical	Ratio of Interior Vertical/ GSF
Law Building	3.2	1.03	43.5	11.54	8.79	4.55	1.48	0.50	1.85	1.34	1:16.1
General Purpose Office Bldg	2.7	0.62	62.3	5.93	6.54	10.61	2.22	0.31	2.19	0.70	1:33.3
Varette Office Building	1.6	0.41	26.4	4.82	5.16	6.52	1.55	0.37	1.85	0.56	1:33.3

ELEMENT COSTS PROFILE



	Cooling tons/1000 GSF	Heating BTU/HR/GSF	%AC	Ventilation CFM/GSF
Law Building	3.2	43.5	100	1.03
General Purpose Office Building	2.7	62.3	90	0.62
Varette Office Building	1.61	26.4	67	0.41

Plumbing costs are similar (Law Building $0.72/GSF, General Purpose Office Building $0.81/GSF, Varette Office Building $0.76/GSF), though the office buildings provide a better fixture ratio viz. 1.10 fixtures/1000 GSF for the General Purpose Office Building, 0.95 fixtures/1000 GSF for Varette, and 0.64 fixtures/1000 GSF for the Law Building. The repetitive toilet layout in the office buildings is very economical.

Both office buildings have higher unit costs for exterior wall than the Law Building (General Purpose Office Building $10.61/GSF, Varette $6.52/GSF, as against $4.55/GSF for Law, but the excellent perimeter/GSF ratio for the office buildings offsets the higher unit costs. In addition, the two office buildings have lower floor-to-floor heights than the Law Building with its two-storey moot court space (average floor-to-floor height: General Purpose Office Building 11.21 feet; Varette Office Building 10.4 feet; Law Building 14.3 feet).

The office buildings also gain in substructure costs (a function of the multi-storey characteristics of small foundation and excavation area) and can easily offset the extra multi-storey costs (highest of the entire sample).

c. Comparison of the Maths & Computer Building, the Systems Dimensions Limited Building, and the Northern Electric Laboratory Building

This summary compares three buildings with a mix of space approximately similar, and approximately equal in cost. All three buildings make extensive provision for computer facilities, or provide for special electrical requirements.

The Maths & Computer Building cost $24.26/GSF, the Systems Dimensions Limited Building $22.58/GSF, and the Northern Electric Laboratory $24.14/GSF. The Systems Dimensions Limited Building includes 21.6% of space as covered parking, with a low structural and service cost. For the Maths & Computer Building, the cost is $38.38/NASF, with a NASF/GSF ratio of 0.63. Systems Dimensions Limited shows a cost of $29.17/NASF and a ratio of 0.77, while the Northern Electric Laboratory has a cost of $32.56/NASF and a ratio of 0.74. Both these buildings have large open areas for office and computer use, so that their NASF areas are not comparable to the Maths & Computer Building which also has a large computer room, but this space is much smaller in area (3.6%) relative to the total NASF for the other two buildings.

COMPARISON OF THE MATHS & COMPUTER BUILDING, THE SYSTEMS DIMENSIONS LTD. BLDG., AND THE NORTHERN ELECTRIC LABORATORY BLDG.

	Cost/ GSF	Cost/ GSF	GSF	NASF/GSF Ratio	Volume/ GSF	Exterior Cladding/ GSF	Roof Area/ GSF	Floors above grade	Floors below grade
Maths & Computer Bldg.	24.26	38.38	299,736	0.63	12.76	0.57	0.18	6	1
Northern Electric Lab.	24.14	32.56	90,147	0.74	14.74	0.42	0.59	2	-
Systems Dimensions Ltd.	22.58	29.17	102,930	0.77	13.67	0.48	0.37	2	1

PERCENTAGE DISTRIBUTION OF NASF BY FUNCTION

	Classroom	Special Purpose	Office	Library	Special Use	General Use	Support	Parking
Maths & Computer Bldg.	23.9	3.6	40.5	1.2	--	10.6	19.6	--
Northern Electric Lab.	--	17.8	73.0	--	2.2	7.0	--	--
Systems Dimensions Ltd.	5.0	--	21.6	1.7	1.5	8.2	40.4*	21.6

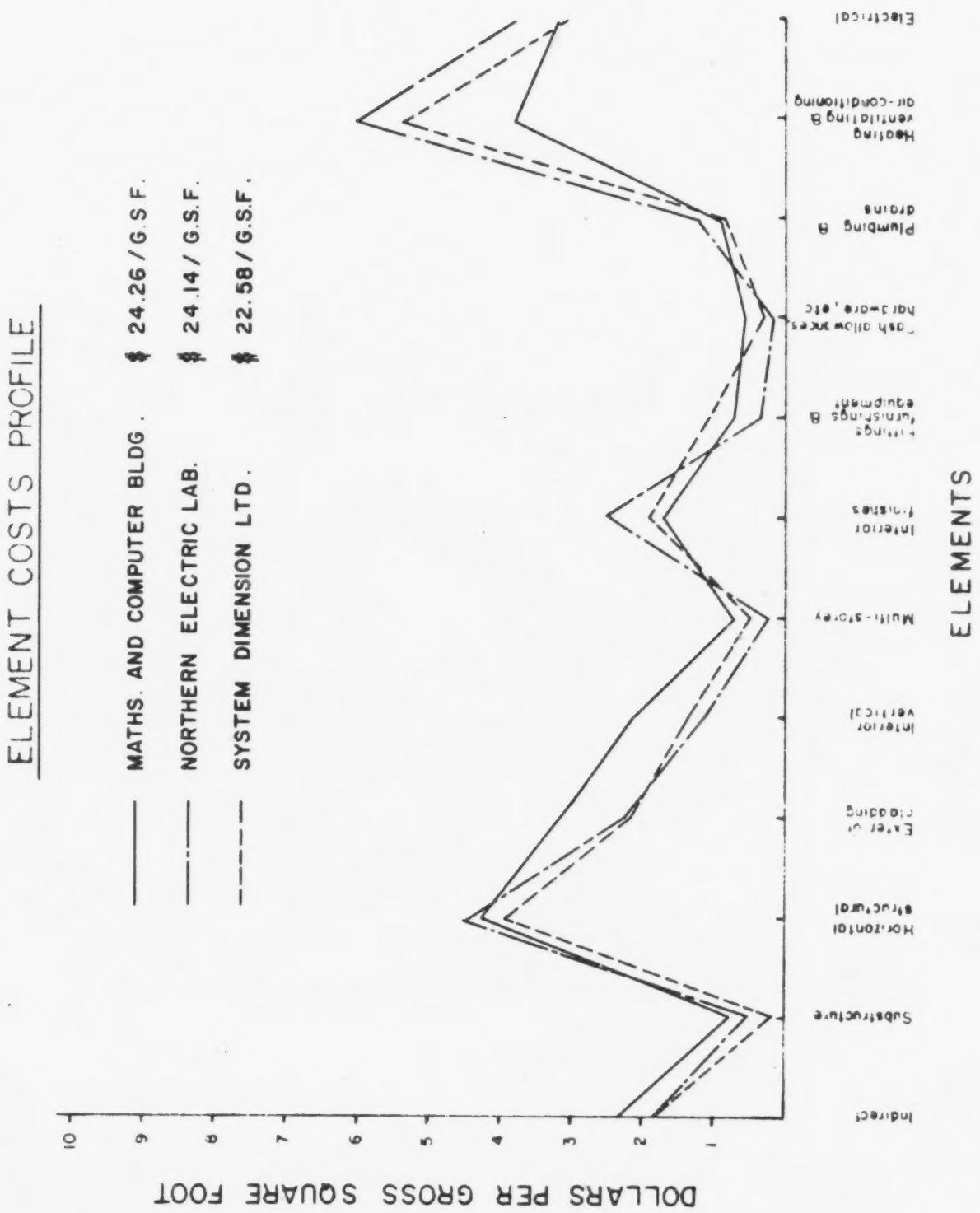
*included 33.6% data processing.

ELEMENT COSTS PER GSF

	Cost/ GSF	Cost/ NASF	1	2	3	4	5	6	7	8	9	10	11	12
Maths & Computer Bldg.	24.26	38.38	2.29	0.79	4.25	3.11	2.08	0.77	1.78	0.78	0.60	0.91	3.84	3.15
Northern Electric Lab.	24.14	32.56	1.77	0.52	4.43	2.18	1.07	0.26	2.48	0.30	0.15	1.20	6.00	3.78
Systems Dimensions Ltd.	22.58	23.17	1.76	0.24	3.94	2.22	1.39	0.55	1.91	1.02	0.25	0.83	5.34	3.10

1: Indirect & General Expenses; 2: Substructure; 3: Horizontal Structure; 4: Exterior Cladding; 5: Interior Vertical; 6: Multi-storey; 7: Interior Finishes; 8: Fittings & Fixtures; 9: Cash Allowance; 10: Plumbing; 11: HVAC; 12: Electrical.

	HVAC										
	Tons/ 1000 GSF	CFM/ GSF	BTU/ HR/ GSF	Shell Cost	Services Cost	Unit Cost of Exterior Walls	Cost/GSF of Ext. Wall	Ratio Ext./ GSF	Unit Cost of Int. Vert. Partitions	Cost/ GSF of Interior Vertical	Ratio of Interior Vertical/ GSF
Maths & Computer Bldg.	2.7	0.78	40.0	8.89	8.62	4.72	2.21	0.57	1.57	1.51	1:11.8
Northern Electric Lab.	4.4	1.59	14.6	7.65	11.79	4.23	1.59	0.42	2.48	0.93	1:23.7
Systems Dimensions Ltd.	2.6	0.97	65.0	6.90	9.99	2.14	0.70	0.48	2.39	1.13	1:38.5


ELEMENT COSTS PROFILE
MATHS. AND COMPUTER BLDG. $ 24.26 / G.S.F.
NORTHERN ELECTRIC LAB. $ 24.14 / G.S.F.
SYSTEM DIMENSION LTD. $ 22.58 / G.S.F.
DOLLARS PER GROSS SQUARE FOOT
ELEMENTS
Indirect
Substructure
Horizontal structural
Exterior cladding
Interior vertical
Multi-storey
Interior finishes
Fittings furnishings & equipment
Cash allowances hardware, etc
Plumbing & drains
Heating ventilating & air-conditioning
Electrical

For the costs of shell and services, the spread is higher for the services ($3.17/GSF) than for the shell ($1.99/GSF). Northern Electric Laboratory has a high HVAC cost ($6.00/GSF) as against Systems Dimensions Limited ($5.34/GSF) and Maths & Computer ($3.84/GSF) but the capacity of the Northern Electric Laboratory HVAC system is almost double the other two buildings in cooling and ventilation. Its heating capacity, however, is of the order of 25-30% of the other buildings, and this is due to high electrical equipment and lighting loads. This building also had approximately $.75/GSF extra electrical cost in providing voltage at 21 KV.

Maths & Computer had a high cost for Interior Vertical elements ($2.07/GSF) as against $1.07/GSF for Northern Electric Laboratory and $1.39/GSF for Systems Dimensions Limited. The unit price for partitions for Maths & Computer was low ($1.57/GSF vs. $2.48/GSF for Northern Electric Laboratory, and $2.39/GSF for Systems Dimensions Limited). However, a low unit price for Maths & Computer could not offset a much higher partition ratio of 1:11.8 (Interior Vertical/GSF) for Maths & Computer as against 1:38.5 for Northern Electric Laboratory and 1:23.7 for Systems Dimensions Limited.

Northern Electric Laboratory had a high cost for interior finishes ($2.48/GSF, rank 3 in overall sample) although this building ranks 9 in overall cost, demonstrating the small impact of the cost of interior finishes on overall cost (see Finding e.).

Northern Electric Laboratory also had the lowest cost/GSF for exterior cladding of the entire sample, and Systems Dimensions Limited ranked 10. Maths & Computer had the lowest cost of the university sample, but was still approximately $.90/GSF more expensive than the other two buildings. Both non-university buildings had a better exterior/GSF ratio than Maths & Computer (0.42, as against 0.57). Systems Dimensions Limited also had a very low unit cost for exterior cladding ($2.14/GSF as against $4.86/GSF for Maths & Computer, and $4.23/GSF for Northern Electric Laboratory), but also had a large area of walls below grade, so that the low cost for above-grade cladding was somewhat offset.

The DCU study provided a detailed analysis of the Northern Electric Laboratory on the basis that there "is no difference between this project and university projects". The analysis performed by the Task Force enables one to see this building in perspective, as predominantly an office building with a relatively small area of electrical laboratories, and with no special plumbing or institutional furnishings.

d. Comments on Other Buildings

(1) Child Study Center

This building ranked 4 in overall cost, at $33.61/GSF, or $54.28/NASF. Its assignable floor area was utilized as 25.8% classroom, 10.6% office, and 42.4% special purpose. The building had a number of spaces containing specialized electronic and audiovisual equipment for the testing and training of children and also included complete

school facilities, a cafeteria, and residential facilities. Programmatically, this was probably the most unusual building in the group.

Horizontal structural costs were the lowest for the group of university buildings; however, the exterior cladding costs were highest for the entire group of buildings.

The cost of the interior finishes was the highest of the entire sample group, much of this attributable to an expensive metal ceiling and to special floor finishes (carpet and quarry tile) necessitated by the building function. Plumbing costs were also high, due to the very high incidence of toilet fixtures.

(2) Crop Science Building

This building ranked highest in overall cost, at $42.39/GSF, or $71.27/NASF. Its assignable floor area was utilized as 76.2% special purpose (laboratories and preparation areas), the highest percentage of the sample. Offices accounted for some 16.2% of the floor area.

Not only was the percentage of the space given over to laboratories very high, but many of their laboratories were engaged in special research (plant growth) calling for special environmental conditions. These involved 1500 foot-candle intensity lighting (fluorescent tubes approximately 9 inches in center, plus incandescent lighting) and very high heating loads. As a result, both electrical and HVAC costs were highest of the sample, and the service elements together cost $20.81/GSF. Fittings and fixtures also ranked high (rank 3, at $3.38/GSF), typical of heavily serviced laboratory buildings.

Shell costs were high (rank 4 at $10.38/GSF), mainly due to a high cost for horizontal structure.

All other elemental costs were modest. Clearly, a combination of high shell costs and very high services costs makes this an expensive building which modest costs in all other elements cannot counterbalance.

This building clearly illustrates the impact of programmatic and functional needs on overall building costs.

(3) Engineering IV

This building ranked second in overall cost, at $36.80/GSF, or $62.33/NASF. Its assignable floor area was utilized as 4.3% classroom, 13.5% office, and 62.6% special purpose, predominantly teaching and specialized laboratories and workshops for a variety of engineering tasks.

This building had the highest shell cost of the entire sample. Its exterior wall/GSF ratio of 0.79:1 is very high, and its unit cost for walls above grade was the highest of the university sample at a cost of $5.14/GSF.

Substructure costs for the Engineering IV Building were the highest of the entire sample, a combination of poor soil conditions and a large foundation area. Interior vertical costs were high (rank 2) and intensity of partitions was also high at a linear foot partition/GSF ratio of 1:12.4.

Both HVAC requirements and cost are high, although this building ranked 3 in comparison with the heavily serviced university buildings.

(4) Georgian CAAT (IIIA)

This building ranked 9 in overall cost, at $23.93/GSF, or $34.17/NASF. Its assignable area was utilized as 2.12% classroom, 5.9% office, 11.9% general use, and 52.1% special purpose, predominantly simple teaching laboratories and workshops.

A small, two-storey building, its costs in all elements were consistently modest. Its electrical costs were a little higher than its overall rank, but its HVAC costs were bettered only by the two high-rise office buildings. HVAC performance matched the costs, although the building is, unlike the office buildings, 100% airconditioned.

5. ADDITIONAL TABLES

The following tables are presented to illustrate some useful ways of comparing some of the information gathered in this study.

Table 4 compares some of the characteristics of the sample buildings that relate to the building configurations.

Table 5 compares the functional mix of space comprising the net assignable floor areas of each sample building.

Table 6 groups some of the elemental costs (from Table 3) in order to isolate the costs of the building shell and services.

Table 7 isolates some comparable measurable characteristics of the HVAC and plumbing elements of the buildings.

CONFIGURATION RATIOS

(High elements underlined; Low elements underlined)

	GSF	NASF	NASF/GSF ratio	Volume/GSF ratio	Wall/ GSF ratio	Roof/ GSF ratio	Floors above grade	Floors below grade
Child Study Building	58,150	36,000	0.62	11.52	0.51	0.20	6	1
Law Building	85,140	52,311	0.61	14.27	0.50	0.39	2	1
Crop Science Building	106,069	63,087	0.59	13.34	0.68	0.50	4	1
Petrie Science Building	131,000	74,710	0.57	12.51	0.57	0.24	3	1
Maths & Computer Building	299,736	189,117	0.63	12.76	0.57	0.18	6	1
Engineering IV Building	170,907	100,908	0.59	14.66	0.79	0.48	av.2	1
Northern Electric Laboratory	90,147	66,820	0.74*	14.74	0.42	0.59	2	-
Systems Dimensions Limited	102,930	79,323	0.77*	13.67	0.48	0.37	2	1
Varette Office Building	317,400	N.A.	N.A.	10.38	0.37	0.05	19	4
General Purpose Office Building	433,410	N.A.	N.A.	11.19	0.31	0.04	22	1
Food & Drug Building	105,675	53,865	0.51	12.57	0.54	0.23	3	1
Georgian CAAT (IIIA)	43,140	30,210	0.70	14.41	0.55	0.55	2	-

* Includes large undivided office areas

N.A. indicates not applicable. See discussion on measurement of NASF in Section 6c.

TABLE 4

TABLE 4

PERCENTAGE DISTRIBUTION OF NET ASSIGNABLE AREA BY FUNCTION (DCU SPACE CLASSIFICATION)

	Classroom	Special Purpose	Office	Library	Special Use	General Use	Support	Indoor Parking
Child Study Building	25.8	42.4	10.6	-	8.1	13.2	-	-
Law Building	16.5	11.8	16.7	50.1	-	4.9	-	-
Crop Science Building	6.3	76.2	16.2	1.4	-	-	-	-
Petrie Science Building	2.2	51.1	21.9	1.4	2.0	2.3	19.1	-
Maths & Computer Building	23.9	3.6	40.5	1.2	-	10.6	19.6	-
Engineering IV Building	4.3	62.6	13.5	-	-	12.0	7.6	-
Northern Electric Laboratory	-	17.8	73.0	-	2.2	7.0	-	-
Systems Dimensions Limited	5.0	-	21.6	1.7	1.5	8.2	40.4*	21.6
Varette Office Building	-	-	78.0	-	-	-	-	22.0
General Purpose Office Building	-	-	92.5	-	-	7.5	-	-
Food & Drug Building	-	31.6	39.5	3.0	1.9	3.8	20.2	-
Georgian CAAT (IIIA)	2.1	52.1	5.9	-	2.7	11.9	6.2	-

* Data Processing 33.6%.

TABLE 5

SHELL, SERVICES AND OTHER ELEMENTAL COSTS

(High elements underlined; Low elements underlined)

	Shell cost elements 2,3,4, + % of 1 Rank		Services cost elements 10-12 + % of 1 Rank		Fixtures & Fittings element 8 + % of 1 Rank		Multi-storey element 6 + % of 1 Rank		Balance elements 5,7,9 + % of 1 Rank	
Child Study Building	2	11.84	5	12.00	7	1.08	3	1.51	1	7.18
Law Building	3	11.54	9	8.79	8	.84	4	.88	4	5.80
Crop Science Building	4	10.83	1	20.81	3	3.34	7	.72	2	6.69
Petrie Science Building	5	9.68	3	14.12	1	4.64	5	.87	5	5.43
Maths & Computer Building	6	8.89	10	8.62	8	.84	6	.84	6	5.07
Engineering IV Building	1	13.30	4	13.80	4	3.23	8	.63	3	5.84
Northern Electric Laboratory	8	7.65	6	11.79	10	.32	11	.28	9	4.10
Systems Dimensions Limited	9	6.90	7	9.99	5	1.09	9	.59	10	4.01
Varette Office Building	12	4.82	12	5.16	11	.11	2	1.75	11	2.89
General Purpose Office Building	11	5.93	11	6.54	12	.07	1	1.89	12	2.74
Food & Drug Building	10	6.78	2	16.49	2	3.89	10	.57	8	4.31
Georgian CAAT (IIIA)	7	8.31	8	9.61	5	1.09	12	.25	6	5.07

TABLE 6

TABLE 6

HVAC AND PLUMBING COSTS

	Tons/ 1000 GSF	Cost	% AC	CFM/ GSF	BTU/HR/ GSF	Thermo-stats/ 1000 GSF	Vol/GSF ratio	Cost/ GSF	Plumbing Fixtures/ 1000 GSF
Child Study Building	3.2	4.90	100	1.00	63.8	1.95	11.52:1	1.92	2.20
Law Building	3.2	4.50	100	1.03	43.5	1.13	14:27:1	0.72	0.64
Crop Science Building	5.7	9.86	100	2.43	102.4	0.95	13.34:1	2.64	0.60
Petrie Science Building	4.4	6.33	100	1.00	61.0	1.55	12.51:1	2.11	0.48
Maths & Computer Building	2.7	3.84	100	0.78	40.0	0.85	12.76:1	0.91	0.63
Engineering IV Building	3.9	6.14	100	1.33	101.5	0.70	14.66:1	1.84	0.50
Northern Electric Laboratory	4.4	6.00	100	1.59	14.6	0.24	14.74:1	1.20	0.63
Systems Dimensions Limited	2.6	5.34	65	0.97	65.0	0.62	13.67:1	0.83	0.70
Varette Office Building	1.6	2.69	67	0.41	26.4	1.40	10.38:1	0.76	0.95
General Purpose Office Building	2.7	2.88	90	0.62	62.3	1.40	11.19:1	0.81	1.10
Food & Drug Building	3.5	7.76	75	0.96	110.0	1.20	12.57:1	3.36	0.78
Georgian CAAT (IIIA)	2.4	3.14	100	0.96	40.0	1.10	14.41:1	1.71	1.49

TABLE 7

TABLE 7

6. COST ANALYSIS - ISSUES

a. The Interim Capital Formula

The interim capital formula dollar allowance presently administered by DCU is set out in Table CS-1 of the DUA Cost Study: Interim report to the CUA (December 1970) as follows:

Construction Cost	$25.19/GSF
Fees and Contingency	2.52/GSF (10% of Construction Cost)
Furniture and Equipment	3.78/GSF (15% of Construction Cost)
Construction Cost Escalation (one year)	1.51/GSF (6% per annum)
GSF/NASF ratio (100/60)	
Total Project Cost Allowance	$55.00/NASF

It is recognized (though not explicitly) that university buildings may vary considerably in their cost because of programmatic requirements: a science laboratory, for example, will cost considerably more than a minimum-serviced arts building. The capital formula allowance is an average figure, and the discrepancy between the costs of different types of buildings is expected to be averaged out over time on a given campus. This expectation assumes that, if a science building may cost more than $55/NASF, it will be compensated for by other structures which will cost less. Thus, justification for each new building must be accompanied by negotiation between the campus planners and the DCU on a basis of mutual understanding, but not explicit budget guidelines.

The interim capital formula allowance procedure raises three major issues to which this Task Force has directed its attention. These issues are:

(1) Is the establishment by DCU of a capital formula dollar allowance a beneficial procedure?

The Task Force considers that the use of a capital formula dollar allowance procedure is beneficial, and should be maintained as a budgeting and cost control tool.

(2) Should the capital formula dollar allowance be a single, average figure, or should it be more explicitly related to the type of building being budgeted?

The Task Force reviewed in some detail the development of a capital formula dollar allowance that would vary with the type of building proposed. The main benefits would be the potential of making the budgeting and cost planning process more precise, reducing the negotiation between the university and DCU, and providing a more explicit basis for whatever negotiation still remained. However, the Task Force agreed that the formula dollar allowance should

remain a single average figure, for the following reasons:

(a) The attempt to provide explicit allowances based on building types would require extensive study and analysis. This present study showed up some of the potential complexity.

(b) A multi-figure allowance would be more difficult to administer, and probably would not reduce significantly the amount of negotiation.

(c) The average figure allows for flexibility in planning, both on the part of the university and DCU, and the necessary negotiations are simpler and more fruitful than if they were more explicitly constrained by cost figures related to building type.

(d) There is now a history of working with an average figure, and to institute a new procedure would entail a new educational process and overall administrative changes.

(3) Is the present average figure of $55/NASF adequate, and upon what basis should it be reviewed?

The present study of comparative costs of university and non-university building has shown that the costs of university buildings are higher. The higher cost results from programme and design requirements. It is beyond the scope of this study to establish whether these requirements are essential or not. This should be the subject of further examination. If it is assumed that they are essential, it does not then make sense to include non-university buildings in a study of an adequate cost allowance for university buildings, particularly when the sample of non-university buildings is so small and diverse. It might be mentioned parenthetically that even if one includes all the non-university buildings in the sample and applies the DCU Basic Analytic Framework one arrives at a capital dollar allowance of $56.26/NASF.

When the DCU Basic Analytic Framework, from which the total project cost allowance of $55/NASF was derived, is applied to the sample of six university buildings the results are illuminating. Though six buildings is obviously a very small sample, it should be recalled that they represent the 25th, 50th, and 75th percentiles in cost range from a total sample of 39 university buildings (Section 8a). The buildings are further divided into three lightly serviced and three heavily serviced.

	Light Service	Heavy Service
Construction cost * (as of Sept. 1971)	$32.50/GSF	$41.12/GSF
	27.01/GSF	33.90/GSF
	23.53/GSF	35.70/GSF
Average	$27.68/GSF	$36.91/GSF
Fees and contingency costs (10% construction cost)	2.77/GSF	3.69/GSF
Furniture and equipment (15% construction cost)	4.15/GSF	5.54/GSF
Total project cost	$34.60/GSF	$46.14/GSF
GSF/NASF ratio (100/60)	$57.30/NASF	$76.90/NASF

Average (light and heavy service)

Construction cost	$32.29/GSF
Fees and contingency costs (10%)	3.23/GSF
Furniture and equipment (15%)	4.84/GSF
Total project cost	$40.36/GSF
GSF/NASF ratio (100/60)	$67.26/NASF

These figures at least suggest some measure of the cost of a group of university buildings, normalized to a single place (Toronto) and a single time (September 1971). Even if the formula allowance was deliberately kept low as a tool of cost reduction control in the expectation that designers will improve on previous average figures, the above figures suggest that $55/NASF is now outdated.

If one takes the lowest-cost university buildings in the sample (representing the 75th percentile of the gross sample) and combines the light-and heavy-service buildings, the result is as follows:

Construction cost	$28.71/GSF
Fees and contingency costs (10%)	2.87/GSF
Furniture and equipment cost (15%)	4.30/GSF
Total project cost	$35.88/GSF
Gross/net ratio (100/60)	$59.80/NASF

It is not suggested that the above figure is definitive. In order to arrive at a valid average figure, it would be necessary to establish a weighted average for each university, based on the relative quantities of light-and heavy-service buildings. This calculation has not been done. The intent here is to establish some orders of magnitude as a prelude to a more detailed study.

* 3% deducted for federal tax rebate

In arriving at an acceptable single figure, the data in this cost study provides much detailed information to assist in arriving at a budget allowance for a specific building. Areas where costs will be incurred through programmatic requirements can be estimated, and the magnitude of these costs gauged and identified on an elemental basis. Areas where savings can be made can similarly be identified. Thus, this study provides a basis for a much more sophisticated development of an average figure than is now possible. Extension and continuation of the development of this cost information, as suggested in Recommendation 7a, together with an examination of furniture and equipment costs, would result in an increasingly more refined and valid information base for reviewing and establishing the formula allowance. Once an acceptable single figure has been established, it could be expected to remain valid only for a short time if building costs continue to escalate.

It is recommended that the formula allowance be formally reviewed yearly by a joint DCU/COU staff committee, not only to take escalation into account, but also new information arising from on-going studies and further experience. As a result of this review, full understanding would be reached between all parties as to the basis of the formula allowance for the following year.

b. Cost Escalation

The methodology for the cost study, which involved re-estimating the study sample, provides a useful check on the effects of cost escalation. While any measure of cost escalation (short of bidding a control group of identical buildings at regular intervals) must be hypothetical, it is felt that the method used here should give a reasonably accurate estimate.

The figures shown in the table make an interesting comparison with those derived from published indices of cost escalation. In general, the study figures show an escalation some 50% less than that suggested by the published indices for the particular group of buildings listed.

Escalation Table

	Total escalation percentage	Southam percentage
University Buildings		
Child Study Center	14.8	32.4
Law Building	18.0	34.3
Crop Science Building	20.8	47.4
Petrie Science Building	19.5	47.4
Maths & Computer Building	25.6	47.4
Engineering IV	10.4	19.5
Non-University Buildings		
Northern Electric Laboratory	22.7	44.7
Systems Dimensions Ltd. Building	17.3	32.9
Varette Office Building	19.7	31.9
General Purpose Office Building	25.3	38.5
Food & Drug Laboratory	--	--
Georgian CAAT (IIIA)	11.0	16.1

c. Measurement of Assignable Area

The gross area of a building is defined as the total area measured flat on a plan for each floor from outside to outside of exterior walls. It includes the actual areas of balconies and mezzanines where these occur within the exterior walls of the building.*

The net assignable area of a building is defined as the area which may be assigned to a specific academic, administrative or general university function. This area does not include circulation and general service areas, such as corridors, staircases, restrooms, washrooms, janitors' closets, mechanical and electrical service rooms, building service staff facilities and general storage areas.

The ratio of net assignable area to gross area of a building is a commonly used measure of the efficiency of a building plan.

NASF/GSF ratios for university buildings nationwide generally average around 0.60. The ratios for the six university buildings in this study ranged from 0.57 to 0.62. Since programming of university facilities is based on assignable area, and building costs are generally budgeted on the basis of cost/assignable area, it is clear that the NASF/GSF ratio may have a considerable effect on building programs and budgets. A difference in NASF/GSF ratio from .55 to .65 represents an 18% increase in assignable area, or potentially a budget decrease of about 15% in planning a new facility. For this reason, the NASF/GSF ratio currently has great force.

This ratio then, provides a measure of that space in the building which is not functionally useful. The largest amount of this non-usable space is taken up by circulation -- corridors, hallways, etc. Effective use of this measure for comparing buildings depends on precise definition of the terms of measurement. Where there is no such agreement comparisons must be treated with the greatest caution. This became apparent in the study when comparing the two high rise buildings (Varette and General Purpose) to the rest of the sample. No information is available on the circulation space used in these buildings except for a standard area around the service core. In addition, the actual layout of many of these office floors, as is typical in commercial office buildings, comprises large open floors in which the circulation space that does exist is not defined by corridor walls. In this study, it was decided that no valid net assignable square foot ratios could be provided for the two general office buildings, and so this measure is omitted rather than to attempt to provide measures of efficiency and cost which would not be comparable to other buildings in the study.

In some other buildings in the study, the NASF/GSF ratios must be treated with caution. Both the Northern Electric Laboratory and the Systems Dimensions Limited Building provide large areas of open office space, which is treated as 100% assignable, although in fact, an indeterminate amount of this space must be used for circulation.

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* See Section 8b for further notes on defining gross area

Concepts of the open planning of office space are starting to invalidate the use of the NASF/GSF ratio as a definitive measure of building efficiency. Office landscaping, as the more sophisticated concepts of open office planning are often called. is starting to be used on university buildings, at present mainly in administrative areas. In elementary and high schools, open planning is being increasingly used in academic areas. If this spreads to university buildings then the NASF/GSF ratio will become even more suspect as an absolute measure, and it seems that cost per gross square foot will become an increasingly useful measure for cost control.

d. University Design Requirements

The variables which make up the cost of a building are complex and hard to identify becuase their analysis is a relatively new form of study. They are not, however, mysterious or irrational. Higher design requirements will mean higher cost. In looking for cost reduction, it is essential to make a careful distinction between those items which provide higher functional performance and those which do not. Increased floor loading of a horizontal structure, increased capacity in the air-conditioning system, increased intensity of plumbing fixtures -- are specific items of higher performance, and these can be objectively measured. However, the need for that higher performance must of course be judgemental.

Additionally, universities by virtue of their programme requirements must often plan for and incorporate a higher degree of flexibility and longevity into their buildings. It goes without saying that these objectives can only be attained by accepting higher unit costs for some of the building elements.

e. University Identity

In those factors which do not provide objectively measured higher performance, the element of judgement may enter very strongly. Some of these factors are of an esthetic nature. Once they can be identified, then conscious statements of esthetic objectives must be made by the owner and responded to by the architect. Traditionally, the university, nationwide and in most countries, has consciously expressed the desire for high esthetic content in its buildings, even if this demand has not been either stated or implemented with the precision that can be applied to objective standards.

This desire for high esthetic content was once expressed in elaborate facades copying medieval or classical models. None of the buildings in this study attempt this form of expression which, today, is very costly indeed. However, university buildings do, in general, use good exterior materials, and considerable care is taken, both in materials and workmanship, to relate one building to another. This is an essential difference between the campus and private building environment, and the university building designer is consciously asked to enhance a coherently designed environment.

To regard low cost as the highest priority, and to remove or minimize the esthetic content of university buildings, would be to impose a significant change of attitude on the physical culture of the campus. Traditionally, it has been accepted that scholarship, research and cultural and social education flourish in a certain kind of environment, not well defined, but generally understood by academicians and designers alike. This environment has been created with greater or lesser success, whether related to the environment as a whole or to the individual buildings. The fact that an individual may greatly dislike the esthetic appearance of a particular building does not invalidate in the least the attempt upon everyone's part -- the academic, the university administrator, the architect -- to ask for, design and pay for a building in which an attempt is made in the best of faith to respond to the traditional demands of the university environment.

Many university buildings are unique in function and use, and do not have equivalents in the outside world. For this reason, they look different and they may cost more money. A few buildings may have functional equivalents in the outside world, but they may, because of the demands of the university environment, also look different, and their costs may also be more.

The university setting is different from the outside world. These differences run deep in our cultural heritage and should not be swept away without serious and careful consideration. The universities, nationwide, have proven to be one of man's most enduring institutions, and in general they have been built to respect this, and have respected it superbly. The university may indeed become more related to the community around it; its activities may in the future take place more in community facilities than on an ivory tower campus. The decision is not lightly to be made that the notion of the campus as a place different in physical atmosphere, and intellectual and social climate from anything else in society, should be abolished, and that there is no reason why the university building should differ in cost or appearance from the commercial office building, the factory, or the grade school.

7. RECOMMENDATIONS

1. The systematic cost/design analysis developed in this study should be applied to the continuing university construction program. In this way, a body of coherent information will be developed which will be of immense value for future cost planning and cost control.

Design requirements and statistical data can be provided by the architect as part of the design package. Cost analysis on an elemental basis can be provided by a cost consultant at the time tenders are received. On this basis, the costs of procuring the information will be minimal.

2. The cost/design information developed in this study provides essential data which could provide a basis for the study of an effective systems building program for the Ontario University system. A study should be instituted to establish the objectives for future university buildings, to establish the cost/benefit parameters for such a program, and to estimate potential benefits and constraints of such programs.

It is suggested that the university might investigate the use of a systems program with the following attributes:

(1) Concentrate on reducing shell costs by providing a simple repetitive structure that could save money with minimum impact on program requirements. Volume purchase of structure for packages of two to four buildings might serve to reduce the university's present disadvantage in having to construct relatively small facilities.

(2) Limit the scope of the systems program to buildings containing the space types exemplified in this study, with the possible addition of libraries. In this way, the systems program will begin to develop for the universities an inventory of simple, inexpensive but highly flexible space.

(3) Select subsystems, from available components, that meet the university's performance requirements within stated elemental cost targets. The time and expense of a large-scale developmental program such as SCSD or SEF is thus obviated.

(4) Begin by running a small-scale pilot program - three or four subsystems for two to four projects - in order to develop procedures and accustom all participants with minimum expenditure of time and money. The program could later be expanded and run on a yearly serial basis, with definition of size of program, scope of components, and cost and performance parameters reviewed each year to keep pace with university needs and those of the local and national economy.

(5) Besides structure, concentrate on the HVAC, partitions, lighting/ ceiling and electrical/electronic subsystems as offering the best benefits. Omit the exterior wall from system consideration but set careful cost targets on this element to control conventional design. In this way, individual campus and architect preferences can be maintained.

3. The data in this report provides a basis for establishing design and cost guidelines, for all building elements, to assist university design architects and engineers. These guidelines should be developed by each university.

Scrutiny of the elemental costs provided in this study should enable elemental cost targets to be set with some degree of accuracy. Guidelines should take the form of suggested cost ranges for those elements that are particularly susceptible to design influence. These are suggested as being elements 3 (Horizontal Structure), 4 (Exterior Cladding), 5 (Interior Vertical), 7 (Interior Finishes), 8 (Plumbing and Drainage), 11 (HVAC) and 12 (Electrical).

4. Each University should initially concentrate on setting guidelines for the cost characteristics of the shell of future projects.

It is apparent that shell costs of university buildings are consistently high. Some of this (related to exterior wall in particular) may be specifically due to high quality exterior design, and this should be carefully evaluated as to its esthetic and functional characteristics, e.g., long life and low maintenance. The remainder is due to complexities of plan form, and the cost of horizontal structure, and savings should be possible here without jeopardizing legitimate programmatic or performance requirements.

5. The second phase of this study should be immediately implemented so as to include life costs, costs of maintenance, operations and change, and to analyze the validity of programmatic needs that result in higher performance requirements and higher cost elements.

While the present investigation provides good information on the relative costs of the elements of the buildings studied, and relates many of these costs to programmatic or performance needs, it cannot justify these needs themselves. To do this requires some study of requirements related to activities - what services and equipment are essential to what activities. In addition some performance items may be justified on a qualitative basis in that they may lengthen the life and reduce the costs of maintenance, operations, or change but this can only be demonstrated by an investigation of long-term building performance.

6. It is recommended that the formula allowance be formally reviewed yearly by a joint DCU/COU staff committee, not only to take escalation into account but also new information arising from on going studies and further experience.

7. It is further recommended that because all the unit costs derived above, including that for the total sample of university and non-university buildings, exceed $55/NASF, an upward adjustment should be made in the unit cost allowance.

8. METHODOLOGY

a. Gross Building Samples

Gross Sample and Selection of University Buildings - Heavy Service

The costs of heavy-service buildings were adjusted by the Southam Index to August 1971 (187.5).

Project			Cost* /NASF	Tender Date	Southam Index	Adjusted Cost	Rank
Carleton	13	Social Science	$63.76	3/66	127.4	$ 93.70	3
Carleton	19	Biology	74.84	7/67	135.3	103.10	1
Carleton	29	Engineering	39.59	10/67	136.9	54.40	15
Guelph	04	Crop Science	58.98	7/66	131.3	84.10	5
Guelph	05	Animal Science	71.00	9/66	131.3	101.30	2
Guelph	07	Physical Sciences	55.18	6/67	135.1	77.00	6
McMaster	17	Psychology	54.16	3/68	139.8	73.00	7
McMaster	46	Life Sciences	55.31	8/70	168.6	61.50 1/	13
Ottawa	14	Engineering	42.69	2/69	146.2	54.80	14
Waterloo	35	Engineering	53.53	3/70	162.0	62.00	12
Western	34	Social Sciences	49.57	10/70	173.3	53.56	16
Windsor	03	Administration	42.57	3/66	127.4	62.80	11
Erindale	08	Research Laboratory	64.42	9/68	143.3	84.20	4
York	26	Science	47.06	9/66	131.3	67.20	8
Waterloo	58	Chemistry I	55.50	4/70	162.0	64.24	10
Western	22	Engineering	54.10	9/69	155.4	65.28	9

From this list, the 25th, 50th and 75th percentile buildings were selected. This would imply selecting the buildings with rank 4 or 5 (25th percentile), rank 8 or 9 (50th percentile) rank 12 or 13 (75th percentile). Therefore, the following buildings were selected for further study: GU04, WA35 and YO26.

*Cost shown on UACP Supplement D Report, subtotal "A" minus site development cost (element 9).

(1) not completed.

Gross Sample and Selection of University Buildings - Light Service

A selection procedure similar to that used for buildings with heavy-service was utilized for this category.

Project			Cost* /NASF	Tender Date	Southam Index	Adjusted Cost	Rank
Carleton	25	Administration	$44.21	11/67	138.6	$60.13	5
Carleton	49	Arts I	56.06	11/69	157.3	67.00	1
Carleton	58	Architecture	46.13	5/71	183.3	47.30 (1)	17
Erindale	13	Library	41.20	6/71	183.5	42.20 (1)	18
Lakehead	32	Academic Building	46.25	3/71	181.1	47.90	16
McMaster	35	Humanities & Soc.Sci.	46.06	3/69	146.2	59.10	9
Ottawa	34	New Child Study Center	45.42	3/69	146.2	59.60	6
Waterloo	17	Math & Computer	27.75	8/66	131.3	38.90	21
Waterloo	67A	Administration	34.28	3/71	181.1	35.50 (1)	23
Waterloo	67B	Student Services	35.01	3/71	181.1	36.30 (1)	22
York	44	Administrative Studies	47.82	8/70	168.6	53.20 (1)	10
York	63	College F	40.87	6/71	183.5	41.70 (1)	20
York	35	General Purpose	44.07	11/67	138.6	59.60	6
York	32	Law	42.86	6/67	135.1	59.48	8
York	36	Library	37.80	5/68	142.3	49.81	12
Queen's	631	Education	38.11	3/69	146.2	48.88	14
Queen's	632	Education	52.51	12/69	157.3	62.59	3
Western	20	Library	37.50	9/68	143.3	48.75 (1)	15
Ottawa	13	Library	57.19	5/70	166.8	41.90	19
Windsor	33	Library	44.00	11/69	157.3	52.40	11
Guelph	06	Library	42.40	8/66	131.1	61.00	4
Waterloo	28	Humanities	50.53	5/68	142.3	66.60	2
Windsor	24	Law	38.20	11/68	144.1	49.60	13

*Cost shown on UACP Supplement D report, subtotal "A" minus site development cost (element 9).

(1) not completed.

The projects ranked 13th and 6th were selected to represent the 50th and 25th percentile respectively. Since the buildings ranked 16th, 17th, 18th, 19th and 20th were not available for selection (they have not been completed and occupied and therefore would not satisfy the requirements for the second phase of the study) it was agreed to select the 21st-ranked building to represent the 75th percentile.

Gross Sample of Non-University Buildings

Gross Sample and Selection of Non-University Buildings - Light Service

Seneca College (1), North York
Seneca College (2), North York
Conestoga College, Kitchener
George Brown College, Toronto
York School of Nursing, North York
Etobicoke Education Center, Etobicoke
Brock Teachers College, St. Catherines
Sudbury Technical College
Greb Administration Building, Kitchener
Queen's Park II Offices, Toronto
Ogilvie Public School, Blackburn
Shorehan Public School
Jane Junior High School, North York
Aurora High School, Aurora
East End High School, Toronto
West End Secondary School, Toronto
Drug Addiction Research, Toronto
Bonaventure Office (General Purpose), Ottawa
Dept. of National Defense Offices, Ottawa
Dominion Bureau of Statistics Office, Ottawa
Royal Canadian Mounted Police Information Center, Toronto
Royal Canadian Mounted Police, National Police Sciences Office
Varette Office Building, Ottawa
AECL Administration Building, South March
System Dimension Limited, Offices, Ottawa
Morse Street Public School, Toronto
Special Vocational School for Girls, Toronto
Mississauga High School, Mississauga
North Bay High School, North Bay
York High School
Sudbury High School, Sudbury

Gross Sample and Selection of Non-University Buildings - Heavy Service

Dow Laboratory 1, Sarnia
Georgian CAAT IIIA, Barrie
West Park Vocational School, Toronto
Northern Electric Laboratory, Toronto
Agricultural Research Laboratory, Harrow
Food & Drug Laboratory, Toronto
AECL, Research and Development Building, Pinawa, Manitoba
AECL, Isotope Production Building, South March
St. Lawrence College, Kingston
Sheridan College, Oakville

b. Rules for Measurement of Areas

GROSS AREA - is the total areas measured flat on a plan for each floor from outside to outside of exterior walls. It includes the actual areas of balconies and mezzanines where these occur within the exterior walls of the building.

Floor areas of spaces extending through two or more floors shall be measured for the largest area at one level only. Such areas will not be factored as suggested by AIA, but the totals should be identified, if significant, for assessment purposes.

It includes all floor areas that have a headroom of six (6) feet or more, penthouses, machine rooms, enclosed connecting links, rooms below grade or sidewalks, true areas of columns, dormers and the like, provided these extend vertically for the full floor height.

It excludes tunnels with less than 6'0" head room, exterior balconies, canopies, areaways, covered walkways, unenclosed exterior staircases and fire escapes, exterior steps and landings, patios, terraces, roof overhangs and cornices and enclosed areas without roofs.

NET ASSIGNABLE AREA - is the area which may be assigned to a specific academic administrative, or general university activity function. This area does not include circulation and general service areas, such as corridors, staircases, restrooms, washrooms, janitors' closets, mechanical and electrical service rooms, building service staff facilities and general storage areas.

c. Element Descriptions

1. INDIRECT AND GENERAL EXPENSES

(a) Indirect and General Expenses

1. Access to site
2. Site offices, storage sheds, latrines, canteens, etc.
3. Site office expenses-telephone, stationery, etc.
4. Hoardings and barricades.
5. Temporary steps, stairs, ladders, scaffolding, etc.

6. Building permit.
7. Bonds - performance and payment.
8. Insurance - fire, public liability, payroll.
9. Financing.
10. Plant and equipment
11. Small tools.
12. Watching.
13. Final clean-up
14. Restoring sidewalks, curbs, etc.
15. Supervision - superintendent, engineer, clerks, etc.
16. Travelling and board.
17. Double shifting and overtime.
18. Job signs.
19. Photographs.
20. Special consideration such as traffic control, road cleaning, etc.

(b) Temporary Roads and Services

1. Temporary fire protection.
2. Temporary lighting, power and water.
3. Temporary roads and parking.

(c) Winter Conditions

1. Winter heat and protection.

(d) Head Office overhead and profit

2. SUBSTRUCTURE

(a) Normal Foundations - this element includes excavation and concrete for wall and column footings, column caps, grade beams, foundation walls and for weeping tile.

(b) Basement - this element includes the additional excavation and backfill required to construct a basement

Items excluded: basement walls and waterproofing, etc.

(c) Special Foundations - this element includes caissons, piling, extra cost of excavating in rock, special shoring or dewatering, and other special foundation conditions.

3. HORIZONTAL STRUCTURAL ELEMENTS

(a) Slabs on Grade - this element includes the slab, fill under the slab, waterproofing and skim coat, or vapour barrier to the slab and small sump pits, construction, expansion and waterproof joints.

Items excluded: final finish to the slab; machinery or boiler bases, structural slabs over crawl spaces.

(b) Floor and Roof Construction - this element includes columns, beams, slabs, floor joists and sub-floors, base plates, anchor bolts and fireproofing for all suspended floors. Rafters, purlins, trusses, roof boarding, roof lights, etc., for the roof construction.

Items excluded: floor finishes, ceiling finishes roof finishes, insulation, cant strips, flashings, roof drains, eavestrough and rainwater leaders.

(c) Roof Finish - this element includes the roof finish, insulation, cant strips, flashings, fascias, eaves, soffit, finish, barge boards, rooflights.

4. EXTERIOR CLADDING

(a) Walls Below Grade - this element includes walls below grade level including waterproofing, insulation and integral pilasters.

Items excluded: wall finishes to the interior face of the wall.

(b) Walls above Grade - this element includes all facing materials, backup, insulation, vapour barriers, strapping, dampproof courses, construction and expansion joints and any applied finishes to external exposed parapet walls above roof line, etc. This element includes items associated with window openings, viz., lintels to support walls above, dampproof courses, caulking, ornamental exterior treatment.

Items excluded: all finishes to the interior face of the wall.

(c) Windows - this element includes frames, sash and glazing, hardware, mullions, transoms, sills flyscreens, storm windows, curtain and window walls.

Items excluded: venetian blinds or sun-shades, valences, curtain tracks, curtains.

(d) Exterior Doors, Entrances & Screens - this element includes doors, roll-up shutters, revolving doors, frames, sub-frames, and sills, lintels, damp-proof courses, surrounds, fly-screen and storm doors, decorations, caulking and special electric or hand-operated opening devices.

This element also includes all store fronts, glazed screens, decorative and functional screens and louvres.

(e) Projections, Balconies, etc. - this element includes any item which, because of its existence, increases the area and cost of the exterior cladding. Examples are:

(1) Overhangs: If one floor projects beyond the floor below it, the exposed ceiling (but not the floor slab) will be included in this element.

(2) Balconies: Projecting balconies will be included in their entirety. Recessed balconies will include the cost of the balcony railing and the floor and exposed ceiling finishes to the balcony (not the building wall or floor slabs).

(3) Fixed and movable sunshades.

As it is often difficult to distinguish between walls, doors, windows and screens, as in the case of curtain walls, the above is given as a guide. Certain elements may have to be combined to avoid entirely arbitrary divisions.

5. INTERIOR VERTICAL ELEMENTS

(a) Partitions - this element includes all interior walls and partitions including structural walls, glazed partitions, movable partitions.

Items excluded: All applied finishes to the partitions.

(b) Folding Doors and Sliding Partitions - this element includes folding or rolling doors, screens and partitions that slide.

(c) Doors - this element includes all interior doors including special doors, frames, decorations.

6. MULTI-STOREY ELEMENTS

(a) Stairs, Steps and Ladders - this element includes all the treads, risers stringers, landings, supporting framework, balustrades, handrails, soffit finishes, steps and ladders.

(b) Catwalks and Gratings - this element includes service platforms, ladders, handrails, catwalks, usually associated with Laboratory Buildings.

(c) Elevators and Hoists - this element includes all the passenger and freight elevators and hoists, entrances, cars, guides, machinery and general contractors' work to provide bases, sumps, fixings, etc.

(d) Escalators

7. INTERIOR FINISHES

(a) Floor Finishes - this element includes all floor finishes together with bases, curbs, mat sinkages, frames and mats.

(b) Ceiling Finishes - this element includes all ceiling finishes, together with cornices.

Items excluded: Special illuminated or heated ceilings, valance boxes.

(c) Wall Finishes - this element includes all applied finishes to walls and partitions.

Items excluded: Walls which are self-finished, when part of Element 5.

(d) Special Finishes - this element includes such finishes as cork insulation for refrigerators, lead lining for x-ray rooms, special murals and similar unusual floor, ceiling and wall finishes.

Items excluded: prefabricated cold and refrigerated rooms, sound chambers, etc.

8. FITTINGS, FURNISHINGS AND BUILDING EQUIPMENT

(a) Non Instructional - this element includes all special general service equipment such as kitchen equipment, pneumatic tube despatch system, stage, swimming pool or laundry equipment, etc.

All fittings and furnishings normally supplied under the general contract, such as: Cupboards, counters, benches, shelving, mirrors, washroom accessories, sculptures, planting boxes, magazine and record racks, tackboards and pinboards, etc.,not used for teaching purposes.

(b) Instructional - this element includes all fittings, furnishings and equipment normally supplied under the general contract, for teaching or research purposes and includes chalkboards, projection screens, built-in seats, etc.

9. CASH ALLOWANCES

This element includes all cash allowances which are normally stated in the specification and which cannot be allocated to any specific element. These might include: Critical Path, Testing and Inspection of Materials, Finishing Hardware, Laboratory Furniture, etc.

Design Contingency and Escalation Allowances shall be excluded.

10. PLUMBING & DRAINS

(a) Roughing-in (Standard) - this element includes all storm, sanitary, hot and cold water piping systems within the exterior walls to washrooms, janitor's closets and all areas not included in 10 b below.

(b) Roughing-in (Special) - this element includes all items in 10 a above to special laboratory instructional areas.

(c) Plumbing Fixtures (Standard) - this element includes all finished plumbing such as water closet bowls, basins, sinks, trim, etc., to all areas not included in 10 d below.

(d) Plumbing Fixtures (Special) - as 10 c above to laboratory and instructional areas.

(e) Fire Protection - this element includes standpipe, fire hose cabinets and sprinkler systems within the building.

Exclude: fire alarm system, if carried in Element 12 d

(f) Special Services System - this element includes the various special plumbing systems, such as glass and resistant waste, ionized water, liquid soap, waste neutralization facilities, etc.

11. HEATING, VENTILATING, AIR CONDITIONING

(a) HVAC - this element includes heating systems, air conditioning and refrigeration, ventilation systems, controls, insulation and plant.

(b) Special Systems - this element includes compressed air, vacuum, oxygen or other gas and special facility distribution systems.

12. ELECTRICAL

(a) Transformers and Distribution - this element includes the primary and secondary transformers and the power and lighting distribution system panels, receptacles and outlets.

(b) Lighting Fixtures and Branch Wiring - this element includes all lighting fixtures, tubes and branch wiring.

(c) Underfloor Duct Systems - this element includes the complete underfloor duct system for power, telephone, P.A., T.V.

Exclude: Cellular decks that are included in 3 b.

(d) Special Services - this item includes all special services such as: wiring and equipment as appropriate for P.A., telephones, radio, fire alarm, emergency lighting, connections for kitchen, laboratory and other special teaching and research equipment, stage lighting, doctors' and nurses' call systems, intercom, central dictaphone, automatic electric locks, T.V. system, provision for future expansion, etc.

Exclude: conduit, if carried in a.

9. GLOSSARY

A.C.	Air Conditioning
BTU/HR	British Thermal Units per hour
CAAT	College of Applied Arts & Technology
CCF	Committee on Capital Financing
C.F.	Cubic Feet
C.F.M.	Cubic feet per minute
COU	Council of Ontario Universities
DCU	Department of Colleges and Universities, previously known as Department of University Affairs (DUA) and recently changed to Ministry of Colleges and Universities.
Element	A major component common to most buildings, usually fulfilling the same function irrespective of its design, specification or construction.
GSF	Gross Square Feet measured in accordance with the rules set out in Section 8b.
Heavy Service Buildings	Science or Engineering buildings containing a high proportion of laboratories or research space.
H.V.A.C.	Heating, Ventilating and Air Conditioning
Light Service Buildings	All buildings not regarded as being heavy service.
NASF	Net Assignable Square Feet, measured in accordance with rules set out in Section 8b.
Shell	All elements comprising the basic building carcass, being foundations, slabs on grade, floor and roof construction, roof finish and all exterior cladding, together with a pro rata allocation of indirect and general expenses.

ED 069254

SUPPLEMENT TO

REPORT OF THE TASK FORCE - BUILDING COSTS

Council of Ontario Universities
Conseil des Universités de l'Ontario
102 Bloor Street West, Toronto 181, Ontario

72-12S
August 1972

This supplement contains the elemental cost analysis and performance and statistical data upon which the report of the C.O.U. Task Force - Building Costs is based. The material has been copied on pre-punched paper and it is suggested that it be placed in a three-ring binder for the convenience of the user.

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CHILD STUDY CENTRE, OTTAWA

Project: OTTAWA 34 - CHILD STUDY CENTRE
COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		177,000		3.04	9.0
2	SUBSTRUCTURE	11,010	5.41	SF Grade Area		59,580		1.02	3.0
	a) Normal Foundations	148	118.64	CY Concrete	17,560		0.30		
	b) Basement Excavations	55,800	0.19	CF Basement Vol.	10,520		0.10		
"	c) Special Foundations	4,120	7.64	LF PC Piles	31,500		0.54		
3	HORIZONTAL STRUCTURAL ELEMENTS	64,405	3.46	SF Struct. Area		223,050		3.84	11.5
	a) Slabs on Grade	11,010	1.26	SF Slab Area	13,840		0.24		
	b) Floor & Roof Construction	53,395	3.47	SF Slab Area	185,210		3.19		
	c) Roof Finish	11,070	2.17	SF Roof Finish	24,000		0.41		
4	EXTERIOR CLADDING	60,224	5.78	SF Wall Area		348,530		6.00	17.8
	a) Walls below Grade	5,873	4.25	SF Wall Area	24,980		0.43		
	b) Walls above Grade	46,989	5.04	SF Wall Area	237,130		4.07		
	c) Windows	6,410	12.29	SF Window Area	78,810		1.36		
	d) Exterior Doors, Entrances, Screen	312	18.62	SF Opening Area	5,810		0.10		
	e) Projections, Balconies, Etc.	640	2.81	SF Soffit Area	1,800		0.03		
5	INTERIOR VERTICAL ELEMENTS	54,386	2.45	SF Part. Area		133,780		2.30	6.8
	a) Partitions *	49,513	1.87	SF Part. Area	92,170		1.58		
	b) Folding ~~or Sliding~~ Partitions	568	14.34	SF Part. Area	8,150		0.14		
	c) Doors	205	163.21	Per Door Leaf	33,460		0.58		

* Incl. Shear Walls

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Project: OTTAWA 34 - CHILD STUDY CENTRE
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		80,950		1.39	4.2
	a) Stairs, Steps & Ladders	21	2093	Per Flight	43,950		0.76		
	b) Catwalks, Gratings	-	-	SF on Plan	-		-		
	c) Elevators & Hoists (Garbage Lift	6	6166	Per Stop	37,000		0.63		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		182,070		3.13	9.3
	a) Floor Finishes	46,614	1.54	SF Finished Area	71,800		1.23		
	b) Ceiling Finishes	52,040	1.34	SF Finished Area	70,030		1.21		
	c) Wall Finishes	66,181	0.60	SF Fin. Wall Area	40,240		0.69		
	d) Special Finishes	-	-		-				
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		57,400		0.99	3.0
	a) Non Instructional	-	-	-	50,400		0.87		
	b) Instructional	-	-	-	7,000		0.12		
9	CASH ALLOWANCES	-	-	-		52,000		0.89	2.6
	a) Hardware	205	195	Per Unit	40,000		0.69		
	b) Testing and Inspection	-	-		12,000		0.20		

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Project: OTTAWA 34 - CHILD STUDY CENTRE
- ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		112,000		1.98	5.7
	a) Roughing-In (Standard)	96	533	Per Fixture	51,250		0.88		
	b) Roughing-In (Special)	46	476	Per Fixture	21,945		0.38		
	c) Plumbing Fixtures (Standard)	96	215	Per Fixture	20,750		0.35		
	d) Plumbing Fixtures (Special)	36	224	Per Fixture	8,055		0.14		
	e) Fire Protection	8	1250	Per Cabinet or Per Head	10,000		0.17		
	f) Special Services	-	-	Per Outlet	-				
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		285,000		4.90	14.6
	a) HVAC	-	-	-	285,000		4.90		
	b) Special Systems	-	-	-		-	-		
12	ELECTRICAL	-	-	-	-	243,000		4.18	12.5
	a) Transformers & Distribution	-	-	-	31,200		0.54		
	b) Lighting Fixtures & Branch Wiring	-	-	-	93,880		1.61		
	c) Underfloor Duct Systems	-	-	-	-		-		
	d) Special Systems	-	-	-	117,920		2.03		
	Federal Sales Tax					1,954,360 (78.160)	*	33.61 (1.34)	100%
						$1,876,200	*	32.27	

* $54.28 / MASF

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Project: OTTAWA 34 - CHILD STUDY CENTRE
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid)			$ 1,863,900
	DEDUCTIONS			
	1.	Contingency (Specified Allowance)	$ 40,000	
	2.	Kitchen Equipment (Low Bid)	25,000	
	3.	Exterior Services (Low Bid)	12,000	
	4.	Exterior Light Standards (Specified Allowance)	1,500	
	5.	Landscaping, Paving and Miscellaneous Sitework (Low Bid)	58,000	
	6.	Miscellaneous Alterations (Estimated)	15,000	
	7.	Tunnel (Estimated)	10,000	161,500
				1,702,400
	8.	Federal Sales Tax		68,100
B)	ADJUSTED BUILDING COST AT APRIL, 1969			$ 1,634,300
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS			1,876,200
D)	COST INCREASE - APRIL 1969 to SEPTEMBER 1971			$ 241,900

The above reflects an increase, or escalation factor of 14.8% of adjusted original low bid amount.

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Project: OTTAWA 34 - CHILD STUDY CENTRE
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	58,150 Sq. Ft.
Net Assignable Floor Area	38,000 Sq. Ft.
Cubic Volume	670,000 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.62:1 Ratio
Exterior Wall Area/Gross Floor Area .	1.02:1 Ratio
Roof Area/Gross Floor Area	0.20:1 Ratio
Volume/Gross Floor Area	11.52:1 Ratio
Floors At and Above Grade	6 No.
Floors Below Grade	1 No.

100

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E-9

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Project: OTTAWA 34 - CHILD STUDY CENTRE
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

1. INDIRECT & GENERAL EXPENSES

Construction Period	17 months
Winter Construction Period	5 months
Performance Bond	50%
Fire Insurance by Owner	No
Market Conditions	Slack (9 bids, range 12%)

2. SUBSTRUCTURE

Type of Soil	Layered fill, sand, clay, silt, shale.
Watertable	Not known
Bearing Capacity of Soil	Not known - but poor since piles are required.
Slope of Site	Nil

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structure Type and Material	Reinforced concrete, flat slab and beams on columns.
Shear Structure	Reinforced concrete wall.
Structural Bay Sizes	Average 24' x 24'
Floor to Floor Heights	2 @ 11' 5-1/2"; 4 @ 10'4"
Structural Depth	Average 8"
Floor Live Loading	100 lbs./sq. ft. - average
Roof Live Loading	48 lbs./sq. ft. - average

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Project: OTTAWA 34 - CHILD STUDY CENTRE
PERFORMANCE & STATISTICAL DATA

Sheet No: 7

3.(c) ROOF FINISH

Roof Finish Type	4 ply felt and asphalt with gravel surfacing; vapour barrier; 1-1/2" insulation.
Rooflights	2%
Perimeter/Roof Area	1:21 Ratio
"U" Factor	0.15

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (Above Grade) .	12%
% Gross Glazed Area Openable	71%
Sun Control Measures	Tinted Glass
Wall Thickness	15" (4" P.C.: 2" Air: 1" insul." 8" concrete backings)
Unglazed "U" Factor	0.148
Inside Face Material	Concrete, concrete block
Exterior Face Material and Finish ...	Precast concrete-exposed multi coloured aggregate in white cement finish; high proportion of non-repetitive panels ; poured concrete-sandblasted finish.
Window Type	Aluminum framed projected, top hung opening-in vents, permanodic finish.
Glazing Type	Double

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area	1:11.63 Ratio

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partition Types	Type	% Area	Height
- Structural (Load-Bearing)	Concrete	17%	Av. 10'0"
- Replaceable .....)	Concrete Block	30%	Av. 9'4"
.....)	Drywall and S.S.	50%	Av. 9'0"
.....)	Glazed	2%	Av. 8'0"
- Sliding and Folding	Vinyl Clad Steel	1%	9'0"
		100%	

Door Types ..... Hollow metal, solid core wood, some having glazed panels.

Doors Ratio ..... 4.1 per 100 Lin. Ft. Partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Poured concrete, spine wall, sandblasted finish.

Elevator Types ..... Electric traction 1 - 2500# passenger, 200 FPM, 6 floors, 6 openings.

Hoist Types ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally carpet: 1/8" vinyl asbestos tile, quarry tile, resilient wood.

Ceilings ..... Generally suspended prepainted metal "paraline": suspended gyproc with painted or texture sprayed finish, acoustic tile on gyproc.

7. INTERIOR FINISHES (cont'd.)

Walls	Generally painted concrete, block and drywall: plastic paint, painted plaster on block and concrete, ceramic tile.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, shelving, coat closets and cupboards, valances, carrels, miscellaneous metal items.
(b) Instructional	Chalk and tack boards, projection screens.

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Stainless steel
(b) Inspection and Testing	Pile load, compaction, concrete, roofing, precast concrete.

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type "L" Copper
Sanitary Soil Piping Type	Cast Iron
Sanitary Waste, Ventilating Piping Type	DWV Copper
Special Piping Type	Nil
Plumbing Fixtures Density per 1000 S.F.	2.2

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Project: OTTAWA 34 - CHILD STUDY CENTRE
PERFORMANCE & STATISTICAL DATA

Sheet No: 10

10. PLUMBING AND DRAINS (cont'd.)

Special Services	Nil

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	100%
Heating Source	Remote
Fuel	Remote
Cooling Source	Remote
Air Handling Source	Building
Capacities Heating	3,700,000 BTU/HP
Cooling Capacity	187 tons
Air Handling CFM	62,000 CFM
Heating Ratio	63.6 BTU/HP per Sq. Ft.
Cooling Ratio	3.21 tons per 1000 GSF
Ventilation Ratio	1.00 CFM per Sq. Ft.
% Return Air	82%
% Main Exhaust	28%
Thermostats per 1000 GSF	1.95
Control Zones	None -(individual control)
Special Systems	Nil

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage ..	Not applicable (voltage was obtained at 600v from nearby structure.)
- KVA Rating/Gross Area Sq. Ft.	Not applicable
- Primary Protection	Not applicable
- Secondary Protection	Breaker
- Main Distribution Board	Not applicable

2. Distribution

- Related to Type of Structure	Mixed
- Voltage of Main Distribution	600v
- Transformation to 120/208v	Scattered

3. Lighting

- Average Intensity of General Lighting in F.C.	70
- Average Cost of General Lighting Fixtures	65
- Branch Circuit Characteristics	EMT - 120/208v
- Switching	Local Switching

4. Motors

- Motor Control Centre	Included
- Base Building Facilities	Air Conditioning

5. Fire Alarm

- Requirements	Heavy

12. ELECTRICAL (cont'd.)

5. Fire Alarm (cont'd.)

- Smoke Detection .....

6. Clocks

- Average Number Clocks ..... Minimum

7. Telephone

- Average Number Telephones ..... Minimum

8. T.V.

- Characteristics ..... Empty Conduit Network

9. Special Requirements of Typical Occupancy

- Some Stage Lighting ..... Approx. $15,500
- Some Intercom ..... Approx. $4,500
- Some Snow Melting ..... Approx. $7,000
- Lighting on 120/208V System .....
- Sound System ..... Approx. $25,500
- Interphone ..... Approx. $6,800
- Emergency Generator ..... Approx. $0,000

LAW BUILDING, WINDSOR

Project: WINDSOR 24 - LAW BUILDING

COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		215,000		2.53	9.1
2	SUBSTRUCTURE	29,700	3.44	SF Grade Area		102,250		1.20	4.3
	a) Normal Foundations	275	93.45	CY Concrete	25,700		0.30		
	b) Basement Excavations	175,811	0.08	CF Basement Vol.	14,550		0.17		
"	c) Special Foundations	-	-	Caisson Piling	62,000		0.73		
3	HORIZONTAL STRUCTURAL ELEMENTS	116,933	4.39	SF Struct. Area		513,500		6.03	21.6
	a) Slabs on Grade	29,700	1.06	SF Slab Area	31,450		0.37		
	b) Floor & Roof Construction	87,233	4.76	SF Slab Area	415,250		4.88		
	c) Roof Finish	32,905	2.03	SF Roof Finish	66,800		0.78		
4	EXTERIOR CLADDING	46,480	6.14	SF Wall Area		285,490		3.35	12.0
	a) Walls below Grade	4,737	4.10	SF Wall Area	19,450		0.23		
	b) Walls above Grade	27,806	4.55	SF Wall Area	126,440		1.48		
	c) Windows	9,566	12.84	SF Window Area	122,850		1.44		
	d) Exterior Doors, Entrances, Screen	571	12.67	SF Opening Area	7,240		0.09		
	e) Projections, Balconies, Etc.	3,800	2.50	SF Soffit	9,510		0.11		
5	INTERIOR VERTICAL ELEMENTS	66,208	2.50	SF Part. Area		165,390		1.94	7.0
	a) Partitions	61,560	1.85	SF Part. Area	113,860		1.34		
	b) Folding ~~xx Sliding~~ Partitions	1,120	20.53	SF Part. Area	23,000		0.27		
	c) Doors	168	170.00	Per Door Leaf	28,530		0.33		

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Project: WINDSOR 24 - LAW BUILDING

Sheet No: 2

- ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

No	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		68,750		0.81	2.9
	a) Stairs, Steps & Ladders	23	1807	Per Flight	41,570		0.49		
	b) Catwalks, Gratings	-	-	SF on Plan	-		-		
	c) Elevators & Hoists	4	6750	Per Stop	27,000		0.32		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		231,860		2.72	9.8
	a) Floor Finishes	82,000	1.06	SF Finished Area	86,460		1.02		
	b) Ceiling Finishes	82,000	1.00	SF Finished Area	82,060		0.96		
	c) Wall Finishes	128,000	0.49	SF Fin. Wall Area	63,340		0.74		
	d) Special Finishes	-	-		-		-		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		66,000		0.77	2.8
	a) Non Instructional	-	-	-	32,000		0.37		
	b) Instructional	-	-	-	34,000		0.40		
9	CASH ALLOWANCES	-	-	-		37,000		0.44	1.6
	a) Hardware	188	165	Per Unit	31,000		0.36		
	b) Inspections and Testing	-	-	-	6,000		0.08		

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Project: WINDSOR 24 - LAW BUILDING
- ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		61,200		0.72	2.6
	a) Roughing-In (Standard)	54	890	Per Fixture	48,000		0.56		
	b) Roughing-In (Special)	-	-	Per Fixture	-		-		
	c) Plumbing Fixtures (Standard)	54	223	Per Fixture	12,000		0.14		
	d) Plumbing Fixtures (Special)	-	-	Per Fixture	-		-		
	e) Fire Protection	23	52	Per Cabinet or Per Head	1,200		0.02		
	f) Special Services			Per Outlet	-		-		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		383,000		4.50	16.2
	a) HVAC	-	-	-	383,000		4.50		
	b) Special Systems	-	-	-	-		-		
12	ELECTRICAL	-	-	-		241,640		2.84	10.1
	a) Transformers & Distribution	-	-	-	67,710		0.80		
	b) Lighting Fixtures & Branch Wiring	-	-	-	114,350		1.34		
	c) Underfloor Duct Systems	-	-	-	-		-		
	d) Special Systems	-	-	-	59,580		0.70		
	Federal Sales Tax Rebate					2,371,080	*	27.85	100%
						(94,850)		(1.11)	
						$ 2,276,230		26.74	

* $45.33 / NASF

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Project: WINDSOR 24 - LAW BUILDING
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid)			$ 2,097,000
	DEDUCTIONS:			
	1. Landscaping	(Specified Allowance)	$ 20,000	
	2. Paving	(Low Bid)	4,500	
	3. Seed and Sod	(Low Bid)	730	
	4. Miscellaneous Exterior Work	(Estimated)	20,000	
	5. Tunnel - Complete	(Estimated)	32,000	
	6. Contingency	(Specified Allowance)	1,000	87,230
				2,009,770
	7. Federal Sales Tax			80,390
B)	ADJUSTED BUILDING CONTRACT COST AT OCTOBER 1968			1,929,380
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS			2,276,230
				$ 346,850

The above reflects an increase, or escalation factor of 18% of adjusted original low bid amount.

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Project: WINDSOR 24 - LAW BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	85,140 Sq. Ft.
Net Assignable Floor Area	52,311 Sq. Ft.
Cubic Volume	1,214,843 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.61:1 Ratio
Exterior Wall Area/Gross Floor Area .	0.50:1 Ratio
Roof Area/Gross Floor Area	0.39:1 Ratio
Volume/Gross Floor Area	14.27:1 Ratio
Floors At and Above Grade	2 No.
Floors Below Grade	1 No.

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Project: WINDSOR 24 - LAW BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 6

1. INDIRECT & GENERAL EXPENSES

Construction Period	22 months
Winter Construction Period	9 months
Performance Bond	50%
Fire Insurance by Owner	No
Market Conditions	Slack (4 bids, range 11%)

2. SUBSTRUCTURE

Type of Soil	Varied - dry brown clay to very wet silty blue clay to bedrock at 90° +
Watertable	15 feet below grade
Bearing Capacity of Soil	Varies with depth of excavation - 4000 to 6000 lbs./Sq. Ft. at 4' to 8', reducing to 0 at 20'.
Slope of Site	0%

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structural Type	Slab, beam and girder.
Material	Reinforced concrete
Shear Structure	Nil
Structural Bay Sizes	30' x 20'
Floor to Floor Heights	12' 5-3/8" (2) and 12' 8-7/8"
Structural Depth	Top of slab to bottom of girder - 4' 8-1/2"
Floor Live Loading	Library 150 lbs./Sq.Ft.; classrooms 100 lbs./Sq.Ft. Mech. room 125 lbs/Sq. Ft.
Roof Live Loading	30 lbs/Sq. Ft.

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L14

3.(c)ROOF FINISH

Roof Finish Type	4 ply felt and pitch, double gravel surfacing; vapour barrier; 1-1/2" insulation; aluminum flashings with duracron finish.
Rooflights	Nil
Perimeter/Roof Area	1:18
"U" Factor	0.15

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (Walls above Grade)	25%
% Glazed area openable	2%
Sun Control Measures	Nil
Wall Thickness	9", 13", 17"
Unglazed "U" Factor	
Inside Face Material	Gyproc
Exterior Face Material .....)	Facebrick
Exterior Finish .....)	
Window Type	Aluminum, duracron finish. 50% of windows are sloped or skylight type.
Glazing Type	Hermetically sealed double in windows- Wired Georgian cast and fibreglass reinforced translucent panels in skylights

Project: WINDSOR 24 - LAW BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 9

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area 1:16.4

Partition Types	Type	% Area	Height
- Structural (Load Bearing)	Concrete	3%	11' 0"
- Replaceable .....)	Facebrick	17%	Av. 11' 0"
.....)	Concrete Block	31%	Av. 11' 0"
.....)	Drywall	45%	Av. 9' 0"
.....)	Glazed	2%	Av. 8' 0"
- Folding	Insul. Steel Soundproof	2%	16' 0"
		100%	

Door Types ..... Hollow metal, plastic laminate solid core, steel vault, some doors with glazed panels.

Doors Ratio ..... 3.2 per 100 Lin. Ft. partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Concrete filled steel pan, quarry tile finish

Elevator Types ..... Electric traction - 1 No. 2500# passenger, 100 FPM, 3 floors, 5 openings.

Hoist Types ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally carpet, 1/8" vinyl asbestos tile, quarry tile, ceramic tile, sealed concrete.

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7. INTERIOR FINISHES (cont'd.)

Ceilings	Generally suspended lay-in acoustic tile: suspended metal linear acoustic system, suspended gyproc,special sloped plaster.
Walls	Generally painted block, concrete and drywall; ceramic tile, vinyl fabric; special acoustic finish.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, shelving, cupboards, lockers.
(b) Instructional	Laboratory furniture, chalk and tack boards, book shelving, projection screens.

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Stainless Steel
(b) Inspection and Testing	Concrete, roofing, structural steel.

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type K Copper
Sanitary Soil Piping Type	Cast iron - Type K Copper
Sanitary Waste, Ventilating Piping ..	Vents: below floor - Type L Copper above floor - Type DWV Copper

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Project: WINDSOR 24 - LAW BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 10

10. PLUMBING AND DRAINS (cont'd.)

Special Piping Type	None
Plumbing Fixtures Density per 1000 S.F.	0.64
Special Services	None

11. HEATING, VENTILATING AIR CONDITIONING (HVAC)

% Building Serviced by AC	100%
Heating Source	Remote
Fuel	None
Cooling Source	Remote
Air Handling Source	Building
Capacities Heating	400 MBH radiation 3,300 MBH heating coils 40,000 CFM
Cooling Capacity	272 tons -
Air Handling CFM	87,100 CFM
Heating Ratio	43.5 BTU/HR/SF
Cooling Ratio	3.2 tons/1000 SF
Ventilation Ratio	1.025 CFM/SF
% Return Air	Summer - 73%: Winter - 65%
% Main Exhaust	Summer - 27%: Winter - 35%
Thermostats per 100 GSF	1.13
Control Zones	Dual duct mixing units - total 101 room thermostats.
Special Systems	Washroom exhaust - 3600 CFM: tunnel exhaust - 2500 CFM: Mech. room exhaust-1000 CFM: transformer room exhaust - 3000 CFM.

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12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage .	5 kv
- Characteristics of Secondary Voltage	120/208v
- KVA Rating/Gross Area Sq. Ft.	10 Watts/Sq. Ft.
- Primary Protection	Load Break Switch
- Secondary Protection	Breaker
- Main Distribution Board	Molded Case

2. Distribution

- Related to Type of Structure	Mixed
- Voltage of Main Distribution	120/208v
- Transformation to 120/208V	Central

3. Lighting

- Average Intensity of General Lighting in F.C.	80
- Average Cost of General Lighting Fixtures	$25.00
- Branch Circuit Characteristics ...	EMT
- Switching	L.V. switching

4. Motors

- Motor Control Centres	Included
- Base Building Facilities	Air Conditioning

12. ELECTRICAL (cont'd.)

5. Fire Alarm
   - Requirements ..... Minimum
   - Smoke Detection .....

6. Clocks
   - Average Number Clocks ..... 1:2,000 Sq. Ft.

7. Telephone
   - Average Number Telephones ..... None

8. T.V.
   - Characteristics ..... Close Cct. System

9. Special Requirements of Typical Occupancy
   - Laboratory ..... None

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CROP SCIENCE BUILDING, GUELPH

Project: GUELPH 04 - CROP SCIENCE BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		385,000		3.61	8.5
2	SUBSTRUCTURE	50,700	3.08	SF Grade Area		156,040		1.47	3.5
	a) Normal Foundations	630	139.37	CY Concrete	87,800		0.83		
	b) Basement Excavations	150,164	0.45	CF Basement Vol.	68,240		0.64		
	c) Special Foundations	-	-	-	-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	172,811	3.60	SF Struct. Area		623,340		5.88	13.9
	a) Slabs on Grade	50,115	1.46	SF Slab Area	73,160		0.69		
	b) Floor & Roof Construction	122,696	3.98	SF Slab Area	488,580		4.61		
	c) Roof Finish	53,490	1.15	SF Roof Finish	61,600		0.58		
4	EXTERIOR CLADDING	75,131	5.62	SF Wall Area		422,200		3.98	9.4
	a) Walls below Grade	18,547	5.17	SF Wall Area	95,810		0.90		
	b) Walls above Grade	46,331	4.95	SF Wall Area	229,560		2.16		
	c) Windows	5,889	10.50	SF Window Area	61,830		0.58		
	d) Exterior Doors, Entrances, Screen	1,473	14.22	SF Opening Area	20,950		0.20		
	e) Projections, Balconies, Etc.	2,891	4.85	SF Soffit Area	14,050		0.14		
5	INTERIOR VERTICAL ELEMENTS	83,387	2.33	SF Part. Area		194,720		1.84	4.3
	a) Partitions	76,987	1.83	SF Part. Area	141,180		1.33		
	b) Folding or Sliding Partitions	580	12.03	SF Part. Area	6,980		0.07		
	c) Doors	291	160.00	Per Door Leaf	46,560		0.44		

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Project: GUELPH 04 - CROP SCIENCE BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		70,060		0.67	1.6
	a) Stairs, Steps & Ladders	9	1,844	Per Flight	16,600		0.15		
	b) Catwalks, Gratings	788	3.00	SF on Plan	2,360		0.02		
	c) Elevators & Hoists	9	5,778	Per Stop	52,000		0.49		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		218,360		2.06	4.9
	a) Floor Finishes	47,524	1.46	SF Finished Area	69,630		0.66		
	b) Ceiling Finishes	104,732	0.80	SF Finished Area	83,800		0.79		
	c) Wall Finishes	126,572	0.46	SF Fin. Wall Area	58,160		0.55		
	d) Special Finishes	22,540	0.30	SF Finished Area	6,770		0.06		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		459,430		3.31	7.6
	a) Non Instructional	-	-	-	12,440		0.12		
	b) Instructional	-	-	-	338,990		3.19		
9	CASH ALLOWANCES	-	-	-		41,000		0.38	0.9
	a) Hardware	300	120.00	Per Unit	36,000		0.34		
	b) Inspections & Testing	-	-	-	5,000		0.05		

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Project: GUELPH 04 - CROP SCIENCE BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		280,000		2.64	6.2
	a) Roughing-In (Standard)	64	1,030	Per Fixture	65,500		0.62		
	b) Roughing-In (Special)	*100	400	Per Fixture	40,000		0.38		
	c) Plumbing Fixtures (Standard)	64	227	Per Fixture	14,500		0.13		
	d) Plumbing Fixtures (Special)	5	200	Per Fixture	1,000		0.01		
	e) Fire Protection	18	1,111	Per Cabinet ~~or Per Head Per Outlet~~	20,000		0.19		
	f) Special Services				139,000		1.31		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		1,045,000		9.86	23.2
	a) HVAC	-	-		650,000		6.13		
	b) Special Systems	-	-	-	395,000		3.73		
12	ELECTRICAL	-	-	-		708,000		6.68	15.8
	a) Transformers & Distribution	-	-		277,200		2.61		
	b) Lighting Fixtures & Branch Wiring	-	-		254,100		2.40		
	c) Underfloor Duct Systems	-	-		23,100		0.22		
	d) Special Systems	-	-	-	153,600		1.45		
						4,496,050	*	42.39	100.0
	Federal Sales Tax Rebate					(134,880)		(1.27)	
						$ 4,361,170		$41.12	

*Assumed - no drawings

* $71.27/M.S.F

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Project: GUELPH 04 - CROP SCIENCE BUILDING
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid)		$ 4,000,000
	DEDUCTIONS:		
	1. Sitework (low bid)	$ 90,000	
	2. Loggia Components (estimated) .	80,000	
	3. Demolitions (low bid)	14,000	
	4. C.P.M. Consultant (low bid) ...	6,000	
	5. Building Furniture (low bid) ..	108,000	298,000
			3,702,000
	6. Federal Sales Tax 3%		111,060
B)	ADJUSTED BUILDING CONTRACT COST AT SEPTEMBER 1966		3,590,940
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS		4,361,170
D)	COST INCREASE - SEPTEMBER 1966 to SEPTEMBER 1971		770,230

The above reflects an increase, or escalation factor, of 20.8% of adjusted original low bid amount.

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Project: GUELPH 04 - CROP SCIENCE BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	106,089 *
Net Assignable Floor Area	63,037 Sq. Ft.
Cubic Volume	1,415,760 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area ...	0.59:1 Ratio
Exterior Wall Area/Gross Floor Area	0.68:1 Ratio
Roof Area/Gross Floor Area	0.50:1 Ratio
Volume/Gross Floor Area	13.34:1 Ratio
Floors t and bove Grade	4 No.
Floors Below Grade	1 No. (partial)

* Floor area check = 105,044 Sq. Ft. excluding 14,001 Sq. Ft. of crawl space and plenums. P.U.A. Report figures therefore have been accepted.

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1. INDIRECT & GENERAL EXPENSES

Construction Period	18 Months
Winter Construction Period	9 Months
Performance Bond	50%
Fire Insurance by Owner	Yes
Market Conditions	Busy (four bids, range 9%)

2. SUBSTRUCTURE

Type of Soil	Dense Granular Soil
Watertable	Av. 5'0" below grade.
Bearing Capacity of Soil	8,000 lbs/Sq. Ft.
Slope of Site	Nil

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

	5-Storey Section	1-Storey Section
Structural Type	R.C. Flat Slab	Steel and Steel Deck
Material		
Shear Structure	None	
Structural Bay Sizes	24'0" x 20'0" (av.)	20'0" x 32'0" (av.)
Floor to Floor Heights	10'0"	13'10"
Structural Depth	10"	1'9"
Floor Live Loading	100 lbs./Sq. Ft.	in conformity with Guelph U. loadings
Roof Live Loading		

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Project: GUELPH 04 - CROP SCIENCE BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 7

3.(c)ROOF FINISH

Roof Finish Type	4 ply felt and asphalt gravel surfacing, galvanized flashings, vapour barrier, 1-1/2" rigid insulation.
Rooflights	None
Perimeter/Roof Area	1:21 Ratio
"U" Factor	0.12

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (of Walls Above Grade)	15%
% Gross Area Openable	None
Sun Control Measures	Tinted glass and curtains
Wall Thickness	11-1/2", 18", 3-1/2"
Unglazed "U" Factor	0.49 0.4 0.87
Inside Face Material	Concrete block
Exterior Face Material ..... Exterior Finish	Precast concrete, exposed concrete, painted concrete Block and metal siding
Window Type	Aluminum with Duracron finish
Glazing Type	Double ..... Single in stairways.

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area	1:12.18 Ratio

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partition Types	Type	% Area	Height
- Structural (Load-bearing)	Concrete	12%	13' 0"
- Replaceable	Concrete block	82%	9"2" and 13' 0"
.....	3" solid plaster	4%	7' 6"
.....	Glazed	1%	7' 6"
- Demountable	Steel panels, aluminum frames	1%	5' 0"
		100%	

Door Types ..... Plastic laminate, solid core wood, louvre, some with glazed panels, hollow metal.

Doors Patio ..... 3.34 per 100 Lin. Ft. Partition.

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Reinforced concrete, steel ladders.

Elevator Types ..... Hydraulic - 1 No. 4000#, 150 FPM., 5 floors, 6 openings.

Hoist Types ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally 1/8 vinyl tile, broadloom, brick paving, ceramic tile and unfinished concrete.

Ceilings ..... Generally acoustic tile, painted plaster, rubbed and painted concrete, painted steel deck, plasticised Byrok C.A.B.

7. INTERIOR FINISHES (cont'd.)

Walls	Generally plasticised Gyrok, painted plaster, painted block and concrete.

8. FITTINGS, FIXTURES AND EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, noticeboard, mat sinkages, lockers, corner guards and miscellaneous metal items.
(b) Instructional	Laboratory equipment and furniture, building furniture and furnishings, chalk and tack boards, coolers and freezers, soil conveyor and bins, spray equipment and miscellaneous.

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Brushed aluminum finish
(b) Inspection and Testing	Concrete, steel, roofing, fill compaction.

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type K Copper
Sanitary Soil Piping Type	Cast iron
Sanitary Waste, Ventilating Piping Type	Type DWV Copper
Special Piping Type	PVC, Duron, aluminum

Project: GUELPH 04 - CROP SCIENCE BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 10

10. PLUMBING AND DRAINS (cont'd.)

Plumbing Fixtures Density per 1000 S.F.	0.6
Special Services	De-ionized and distilled water, vacuum, natural gas, compressed air, acid drainage.

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	100%
Heating Source	Remote
Fuel	N.A.
Cooling Source	Remote
Air Handling Source	Building
Capacities Heating	10,863,000 BTU/HR
Cooling Capacity	612 tons
Air Handling CFM	257,000 CFM
Heating Ratio	102.4 BTU/HR per sq. ft.
Cooling Ratio	5.7 tons per 1000 GSF
Ventilation Ratio	2.43 CFM per sq. ft.
% Return Air	75% in office areas
% Main Exhaust	25% in office areas
Thermostats per 1000 GSF	.95
Control Zones	39 (excluding stairs and fan coil units)
Special Systems	Fume hood exhaust ducts and fans. High volume ventilation systems to growth rooms. Dust arrestors. Heating and Cooling system water treatment. Special controls.

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12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage	13.8 kv
- Characteristics of Secondary Voltage	120/208
- KVA Rating/Gross Area Sq. Ft..	18 Watts/Sq. Ft.
- Primary Protection	Load Break Switch
- Secondary Protection	Breaker
- Main Distribution Board	Molded Case

2. Distribution

- Related to Type of Structure..	Horizontal
- Voltage of Main Distribution..	120/208

3. Lighting

- Average Intensity of General Lighting in F.C.	3.5
- Average Cost of General Lighting Fixtures	$30.00
- Branch Circuit Characteristics	EMT
- Switching	L.V. Switching

4. Motors

- Motor Control Centres	Included
- Base Building Facilities	Air Conditioning

12. ELECTRICAL (cont'd.)

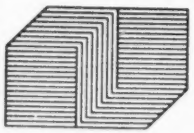
5. Fire Alarm
   - Requirements ..... Minimum
   - Smoke Detection .....

6. Clocks
   - Average Number Clocks ..... 1 Minimum sq. ft.

7. Telephone
   - Average Number Telephones .... 1 Minimum sq. ft.

8. T.V.
   - Characteristics ..... Close Cct. System - minimum

9. Special Requirements of Typical Occupancy
   - Special Lighting in Growth Area
   - Emergency System (No Detail)
   - Wiring for Lab Equipment



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PETRIE SCIENCE BUILDING, YORK

Project: YORK 26 - PETRIE SCIENCE BUILDING
COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		387,000		2.95	8.5
2	SUBSTRUCTURE	34,807	1.65	SF Grade Area		57,480		0.43	1.2
	a) Normal Foundations	288	57.98	CY Concrete	16,700		0.12		
	b) Basement Excavations	334,582	0.12	CF Basement Vol.	40,780		0.31		
	c) Special Foundations	-	-	-	-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	170,520	3.64	SF Struct. Area		622,280		4.75	13.7
	a) Slabs on Grade	34,807	1.18	SF Slab Area	40,930		0.31		
	b) Floor & Roof Construction	135,713	3.62	SF Slab Area	491,410		3.75		
	c) Roof Finish	45,798	1.96	SF Roof Finish	89,940		0.69		
4	EXTERIOR CLADDING	83,455	5.89	SF Wall Area		491,540		3.75	10.8
	a) Walls below Grade	19,124	4.49	SF Wall Area	85,830		0.66		
	b) Walls above Grade	43,369	4.62	SF Wall Area	200,000		1.52		
	c) Windows	11,694	14.11	SF Window Area	165,000		1.26		
	d) Exterior Doors, Entrances, Screen	966	8.73	SF Opening Area	8,430		0.06		
	e) Projections, Balconies, Etc.	8,302	3.89	SF Soffit Area	32,230		0.25		
5	INTERIOR VERTICAL ELEMENTS	137,165	2.58	SF Part. Area		356,840		2.73	7.8
	a) Partitions	126,226	2.23	SF Part. Area	280,800		2.15		
	b) Folding ~~or Sliding~~ Partitions	205	18.00	SF Part. Area	3,690		0.03		
	c) Doors	459	157.63	Per Door Leaf	72,350		0.55		

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Project: YORK 26 - PETRIE SCIENCE BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		105,090		0.80	2.3
	a) Stairs, Steps & Ladders	15	1,878	Per Flight	28,180		0.22		
	b) Catwalks, Gratings	145	14.51	SF on Plan	1,910		0.01		
	c) Elevators & Hoists	9	8,333	Per Stop	75,000		0.57		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		192,030		1.47	4.2
	a) Floor Finishes	127,335	0.42	SF Finished Area	53,660		0.41		
	b) Ceiling Finishes	135,480	0.61	SF Finished Area	83,110		0.64		
	c) Wall Finishes	269,476	0.20	SF Fin. Wall Area	53,760		0.41		
	d) Special Finishes	960	1.56	SF Finished Area	1,500		0.01		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		560,000		4.26	12.3
	a) Non Instructional	-	-	-	78,000		0.60		
	b) Instructional	-	-	-	482,000		3.68		
9	CASH ALLOWANCES	-	-	-		74,250		0.57	1.6
	a) Hardware	475	150.00	Per Unit	71,250		0.55		
	b) Inspection & Testing	-	-	-	3,000		0.02		

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Project: YORK 26 - PETRIE SCIENCE BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		277,000		2.11	6.1
	a) Roughing-In (Standard)	50	1,300	Per Fixture	65,000		0.50		
	b) Roughing-In (Special)	*200	273	Per Fixture	54,600		0.41		
	c) Plumbing Fixtures (Standard)	50	200	Per Fixture	10,000		0.07		
	d) Plumbing Fixtures (Special)	12	200	Per Fixture	2,400		0.02		
	e) Fire Protection	26	1,250	Per Cabinet	32,500		0.25		
	f) Special Services	-	-		112,500		0.86		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		828,000		6.33	18.2
	a) HVAC	-	-		628,000		4.79		
	b) Special Systems	-	-	-	200,000		1.54		
12	ELECTRICAL	-	-	-		599,860		4.57	13.2
	a) Transformers & Distribution	-	-		76,010		0.58		
	b) Lighting Fixtures & Branch Wiring	-	-		258,720		1.97		
	c) Underfloor Duct Systems	-	-		28,000		0.21		
	d) Special Systems	-	-	-	237,130		1.81		
	Federal Sales Tax Rebate (4%)					4,551,370 (182,050)	*	34.74 (1.38)	100.0
					$	4,369,320		33.35	

* Assumed - No drawings.

* $60.92/NASF

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Project: YORK 26 - PETRIE SCIENCE BUILDING
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid)		$ 3,588,000
	DEDUCTIONS		
	1. Observatory and Link (Estimated)	$ 140,000	
	2. Tunnels (Estimated)	44,000	
	3. Ext. Precast Steps and Loggia Components (Estimated)	22,000	206,000
			3,382,000
	4. Federal Sales Tax 4%		135,280
			$ 3,245,720
	ADDITION:		
	1. Laboratory Furniture (Low Bid)		410,000
B)	ADJUSTED BUILDING CONTRACT COST AS SEPTEMBER 1966		3,656,720
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS		4,369,320
D)	COST INCREASE - SEPTEMBER 1966 TO SEPTEMBER 1971		$ 712,600

The above reflects an increase, or escalation factor, of 19.5% of adjusted original low bid amount.

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Project: YORK 26 - PETPIE SCIENCE BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	131,000 Sq. Ft.
Net Assignable Floor Area	74,710 Sq. Ft.
Cubic Volume	1,639,020 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.57:1 Ratio
Exterior Wall Area/Gross Floor Area	0.51:1 Ratio
Roof Area/Gross Floor Area	0.24:1 Ratio
Volume/Gross Floor Area	12.51:1 Ratio
Floors At and Above Grade	3 No.
Floors Below Grade	1 No. (plus one partial sub-basement).

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Project: YORK 26 - PETRIE SCIENCE BUILDING
PERFORMANCE AND STATISTICAL DATA

Sheet No: 6

1. INDIRECT & GENERAL EXPENSES

Construction Period	20 months
Winter Construction Period	9 months
Performance Bond	50 Per Cent
Fire Insurance by Owner	Yes
Market Conditions	Busy - 4 Bids, Range 10%.

2. SUBSTRUCTURE

Type of Soil	Sandy Silt to Clay at 21'
Watertable	15 Ft. Below Grade
Bearing capacity of Soil	3,000 lbs./Sq. Ft.
Slope of Site	10 %

3. (b) HORIZONTAL STRUCTURAL ELEMENTS

Structural Type Material	79% R.C. Joist/Slab 21% R.C. Flat Slab and Beam
Shear Structure	R.C. Walls
Structural Bay Sizes	20'0" Span: Joist/Slab 10'0" x 10'0" Flat Slab
Floor to Floor Heights	Av: 12'0"
Structural Depth	16' Joist'Slab 8" Flat Slab
Floor Live Loading	85 lbs./Sq. Ft. Offices 150 lbs./Sq.Ft. Lab.
Roof Live Loading	40 lbs./Sq. Ft.

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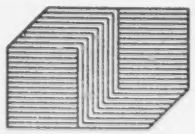
3.(c) ROOF FINISH

Roof Finish Type	4 ply felt & pitch; double gravel surfacing; vapour barrier; 1 1/2" insulation; lead coated copper flashings
Rooflights	2.25%
Perimeter/Roof Area	1:16 Ratio
"U" Factor	0.15

4. EXTERIOR CLADDING

% Total sq. ft. glazed ..... (of walls above grade)	19 %
% Glazed area openable	.01 %
Sun Control Measures	Between glass venetian blinds
Wall Thickness	16" 13" 8"
Unglazed "U" Factor	Av. 0.47
Inside Face Material	Concrete block, concrete
Exterior Face Material	Exposed concrete sandblasted, brick, metal louvres
Exterior Finish	
Window Type	Thermal broken aluminum, Duracron finish
Glazing Type	Double



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5. INTERIOR VERTICAL ELEMENTS

Linear Ft. Partitions/Gross Floor Area ..... 1:10:80 Ratio

Partition Types	Type	% Area	Height
- Structural (load-bearing)	Concrete	29%	Av. 11'0"
- Replaceable	Concrete Block	68%	Av. 11'0"
- Replaceable	Glazed	1%	8'0"
- Demountable	Steel Panel	2%	9'8"
		100%	

Doors Types ..... Hollow metal, solid core wood, some having glazed panels

Doors Ratio ..... 4.04 per 100 Lin. Ft. Partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Steel with P.C. Terrazzo treads & landings, steel ladders

Elevator Types ..... Hydraulic - 1 No. 3500# passenger, 150 FPM., 4 floors, 4 openings, Hydraulic - 1 No. 7000# freight, 100 FPM., 5 floors, 5 openings

Hoist Types ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally unfinished exposed concrete, 1/8 vinyl asbestos tile, terrazzo

Ceilings ..... Generally rubbed & painted concrete ribbed structure, lay in acoustic tile,

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7. INTERIOR FINISHES (cont'd.)

Ceilings (cont'd.)	lath & plaster
Walls	Generally painted concrete & concrete block, ceramic tile, plastic painted concrete & concrete block.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, shelving, coat closets & cupboards, lockers, monorail, mailboxes & miscellaneous metal items
(b) Instructional	Laboratory equipment & furniture, building furniture & furnishings, chalk & tack boards, floating floor

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Brushed Aluminum
(b) Inspection & Testing	Soil & fill compaction, concrete, roofing, precast concrete

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Project: YORK 26 - PETRIE SCIENCE BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 10

10. PLUMBING AND DRAINS

Hot & Cold Water Piping Type	Copper type "K"
Sanitary Soil Piping Type	Cast Iron
Sanitary Wast, Ventilating Piping Type	Copper type "DWV"
Special Piping Type	Glass, PVC
Plumbing Fixtures Density per 1000 S.F.	0.48
Special Services	Acid drainage, natural gas, compressed air, de-ionized water, vacuum, lab exhaust piping

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	100%
Heating Source	Remote
Fuel	N.A.
Cooling Source	Remote
Air Handling Source	Building
Capacities:Heating	8,000,000 BTU/HR
Cooling	580 Tons
Air Handling CFM	130,000 CFM
Heating Ratio	61 BTU/HR per sq. ft.
Cooling Ratio	4.42 Tons per 1000 GSF
Ventilation Ratio	1.00 CFM per sq. ft.
% Return Air	Nil % in office areas
% Main Exhaust	100 % in office areas
Thermostats per 1000 GSF	1.55

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC) (cont's.)

Control Zones	17 main zones
Special Systems	Fume hood exhaust ducts and fans; Shop exhaust systems

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage	13.8 kv
- Characteristics of Secondary Voltage ..	347/600 and 120/208v
- KVA Rating/Gross Area Sq. Ft.	1000/131,000 - 8 Watts/Sq. Ft.
- Secondary Protection	Breaker
- Main Distribution Board	

2. Distribution

- Related to Type of Structure	Mixed
- Voltage of Main Distribution	347/600 and 120/208

3. Lighting

- Average Intensity of General Lighting in F.C.	100
- Average Cost of General Lighting Fixtures	$35.00
- Branch Circuit Characteristics	EMT
- Switching	L.V. switching

12. ELECTRICAL (cont'd.)

4. Motors

- Motor Control Centre ..... Included
- Base Building Facilities ..... Air Conditioning

5. Fire Alarm

- Requirements ..... Minimum
- Smoke Detection .....

6. Clocks

- Average Number Clocks ..... Minimum

7. Telephone

- Average Number Telephones ..... Minimum

8. T.V.

Characteristics ..... Minimum Empty Conduit Network.

9. Special Requirements of Typical Occupancy

- Laboratory Sq. Ft./Gross Area .. 30%

MATHEMATICS AND COMPUTER BUILDING, WATERLOO

Project: UNIVERSITY OF WATERLOO
WA. 17 - MATHEMATICS & COMPUTER BUILDING
COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-	-	660,000		2.20	9.1
2	SUBSTRUCTURE	46,343	5.11	SF Grade Area		236,860		0.79	3.3
	a) Normal Foundations	1,940	85.35	CY Concrete	166,100		0.55		
	b) Basement Excavations	472,836	0.11	CF Basement Vol.	53,660		0.18		
	c) Special Foundations	1,140	15.00	LF. Wellpointing	17,100		0.06		
3	HORIZONTAL STRUCTURAL ELEMENTS	346,706	3.67	SF Struct. Area		1,271,580		4.25	17.5
	a) Slabs on Grade	46,343	0.94	SF Slab Area	43,630		0.15		
	b) Floor & Roof Construction	300,363	3.79	SF Slab Area	1,137,680		3.80		
	c) Roof Finish	55,327	1.63	SF Roof Finish	90,270		0.30		
4	EXTERIOR CLADDING	189,960	4.86	SF Wall Area		924,170		3.11	12.8
	a) Walls below Grade	13,687	4.42	SF Wall Area	60,530		0.20		
	b) Walls above Grade	139,540	4.72	SF Wall Area	658,820		2.21		
	c) Windows	15,500	7.82	SF Window Area	121,170		0.41		
	d) Exterior Doors, Entrances, Screen	1,464	11.88	SF Opening Area	17,400		0.07		
	e) Projections, Balconies, Etc.	19,775	3.35	SF Soffit Area	66,250		0.22		
5	INTERIOR VERTICAL ELEMENTS	517,227	1.21	SF Part. Area		623,410		2.08	8.6
	a) Partitions	289,367	1.57	SF Part. Area	453,070		1.51		
	b) Folding ~~or Sliding~~ Partitions	810	18.00	SF Part. Area	14,580		0.05		
	c) Doors	1,082	144.00	Per Door Leaf	155,760		0.52		

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Project: UNIVERSITY OF WATERLOO
WA. 17 - MATHEMATICS & COMPUTER BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		231,080		0.77	3.1
	a) Stairs, Steps & Ladders	32	2,938	Per Flight	94,020		0.31		
	b) Catwalks, Gratings	300	3.53	SF on Plan	1,060		0.01		
	c) Elevators & Hoists	24	5,666	Per Stop	136,000		0.45		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		533,640		1.78	7.3
	a) Floor Finishes	289,873	0.70	SF Finished Area	201,930		0.67		
	b) Ceiling Finishes	298,033	0.63	SF Finished Area	186,390		0.62		
	c) Wall Finishes	512,945	0.28	SF Fin. Wall Area	145,320		0.49		
	d) Special Finishes	-	-	-	-		-		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		236,000		0.78	3.2
	a) Non Instructional	-	-	-	147,000		0.49		
	b) Instructional	-	-	-	89,000		0.29		
9	CASH ALLOWANCES	-	-	-		180,300		0.60	2.5
	a) Hardware	1,082	150.00	Per Unit	162,300		0.55		
	b) Inspection & Testing	-	-	-	8,000		0.05		

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Project: UNIVERSITY OF WATERLOO
WA. 17 - MATHEMATICS & COMPUTER BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		272,000		0.91	3.8
	a) Roughing-In (Standard)	214	795.00	Per Fixture	170,000		0.57		
	b) Roughing-In (Special)	-	-	Per Fixture	-		-		
	c) Plumbing Fixtures (Standard)	214	280.00	Per Fixture	60,000		0.20		
	d) Plumbing Fixtures (Special)	-	-	Per Fixture	-		-		
	e) Fire Protection	55	763.00	Per Cabinet ~~or Per Head~~	42,000		0.14		
	f) Special Services	-	-	Per Outlet	-		-		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		1,147,000		3.84	15.8
	a) HVAC	-	-		1,019,000		3.41		
	b) Special Systems 1)Computer A/C	-	-		103,000		0.34		
	2)Glycol	-	-		25,000		0.09		
12	ELECTRICAL	-	-	-		942,480		3.15	13.0
	a) Transformers & Distribution	-	-		213,650		0.71		
	b) Lighting Fixtures & Branch Wiring	-	-		456,250		1.53		
	c) Underfloor Duct Systems	-			113,190		0.38		
	d) Special Systems	-	-	-	159,390		0.53		
	Federal Sales Tax Rebate					7,258,520	*	24.26	100%
						(217,760)		(.73)	
						7,040,760		23.53	

* $38.38 / NASF

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Project: WA.17 MATHEMATICS & COMPUTER BUILDING
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid Alternative)			$ 5,974,000
	DEDUCTIONS:			
	1. Sitework (low bid)	20,000		
	2. Landscaping & Paving (low bid)	33,000		
	3. Contingency (Spec'd. All'nce)	75,000		
	4. Critical Path Scheduling (Spec'd. All'nce)	15,000		
	5. P.C. & Brick Paving (low bid)	45,000		
	6. Miscellaneous Ext. Work (estimated)	7,000		195,000
				$ 5,779,000
	7. Federal Sales Tax			173,370
B)	ADJUSTED BUILDING CONTRACT COST AT JUNE, 1966			$ 5,605,630
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS			$ 7,040,760
D)	COST INCREASE - JUNE 1966 TO SEPTEMBER 1971			$ 1,435,130

The above reflects an increase, or escalation factor of 25.6% of adjusted original low bid amount.

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Project: WATERLOO 17 - MATHEMATICS & COMPUTER BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	299,730 Sq. Ft.
Net Assignable Floor Area	189,117 Sq. Ft.
Cubic Volume	3,825,000 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.63:1 Ratio
Exterior Wall Area/Gross Floor Area ...	0.57:1 Ratio
Roof Area/Gross Floor Area	0.13:1 Ratio
Volume/Gross Floor Area	12.76:1 Ratio
Floors At and Above Grade	6 No.
Floors Below Grade	1 No.

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Project: WATERLOO 17 - MATHEMATICS & COMPUTER BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 6

1. INDIRECT & GENERAL EXPENSES

Construction Period	30 Months
Winter Construction Period	13-1/2 Months
Performance Bond	100%
Fire Insurance by Owner	Yes
Market Conditions	Slack (6 bids, range 10%)

2. SUBSTRUCTURE

Type of Soil	Dense granular silt
Watertable	15-20 feet below grade
Bearing Capacity of Soil	8,000 lbs/Sq. Ft.
Slope of Site	Nil

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structural Type	82% reinforced concrete joist/slab
Material	18% reinforced concrete flat slab and beam
Shear Structure	Reinforced concrete walls
Structural Bay Sizes	19'6" x 30'0" joist/slab; average 12'0" span flat slab
Floor to Floor Heights	Average 13'0"; 2-average 12'1"; 1- 15'3".
Structural Depth	21-1/2" joist/slab; average 7" flat slab.
Floor Live Loading	100 lbs./Sq. Ft.
Roof Live Loading	48 lbs/Sq. Ft.

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Project: WATERLOO 17 - MATHEMATICS & COMPUTER BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 7

3.(c) ROOF FINISH

Roof Finish Type	4 ply felt and asphalt; gravel surfacing; vapour barrier; 1-1/2" and 2" insulation; mill finished aluminum flashings.
Rooflights	0.014%
Perimeter/Roof Area	1:21 Ratio
"U" Factor	0.12

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (Walls above Grade)	11%
% Glazed Area Openable	None
Sun Control Measures	None
Wall Thickness	15", 12", 8", 6".
Unglazed "U" Factor	Average 0.133 floors 1-3; average 0.15 floors 4-6.
Inside Face Material	Concrete block, concrete, plaster.
Exterior Face Material	Precast concrete - hammered rib and plain smooth finish.
Exterior Finish	Facebrick, metal louvres.
Window Type	Aluminum, Duracron finish
Glazing Type	Single

5. INTERIOR VERTICAL ELEMENTS

Linear Ft. Partitions/Gross Floor Area .	1:11.8 Ratio

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partition Types	Type	% Area	Height
- Structural (Load-Bearing)	Concrete	11.4%	Av. 11'2"
- Replaceable	Concrete block	74.7%	11'9"
.....	Brick and concrete block	1.8%	11'9"
.....	Glazed	1.9%	8'0"
.....	Steel stud and drywall	9.3%	8'0"
- Demountable	Steel panel	0.6%	10'0"
- Folding	Vinyl covered steel	0.3%	10'0"
		100.0%	

Doors Types ..... Glazed aluminum, solid core wood, plastic laminate, some having glazed panels, transom panels.

Doors Ratio ..... 4.25 per 100 Lin. Ft. partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Concrete with P.C. Terrazzo treads and landings, steel ladders, (stairs large scale).

Elevator Types ..... Electric traction - 4 No. 3500# passenger, 300 FPM, 6 floors, 6 openings.

Hoist Types ..... Nil

Project: WATERLOO 17 - MATHEMATICS & COMPUTER BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 2

7. INTERIOR FINISHES

Floors	Generally 1/8" vinyl asbestos tile, terrazzo, ceramic tile, hardwood block, carpet, sealed exposed concrete.
Ceilings	Generally suspended lay-in acoustic tile, rubbed and painted exposed concrete structure, painted plaster, special amphitheatre acoustic ceiling.
Walls	Generally rubbed and painted concrete, painted and concrete block, painted plaster, painted drywall, acoustic plaster in amphitheatre, ceramic tile, plastic painted concrete and concrete block.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, shelving, cupboards, coat and hat racks, signs, paper baler and miscellaneous metal items.
(b) Instructional	Laboratory furniture, chalk and tack boards, aluminum pedestal floating floor, projection screens.

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Brushed aluminum
(b) - Inspection and Testing	Soil and fill compaction, concrete, roofing, precast concrete.

Project: WATERLOO 17 - MATHEMATICS & COMPUTER BUILDING
PERFORMANCE & STATISTICAL DATA

Sheet No: 10

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type K Copper
Sanitary Soil Piping Type	Cast iron
Sanitary Waste, Ventilating Piping Type	Type DWV Copper
Special Piping Type	None
Plumbing Fixtures Density per 1000 SF .	0.7
Special Services	None

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	100%
Heating Source	Remote
Fuel	Gas
Cooling Source	Remote
Air Handling Source	Building
Capacities Heating	12,000,000 BTU/HR
Cooling Capacity	820 tons
Air Handling CFM	234,000 CFM
Heating Ratio	40 BTU/HR per Sq. Ft.
Cooling Ratio	2.7 tons per 1000 GSF
Ventilation Ratio	.78 CFM per Sq. Ft.
% Return Air	88%
% Main Exhaust	12%
Thermostats per 1000 GSF	0.85

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11. HEATING, VENTILATING, AIR CONDITIONING (HVAC) (cont'd.)

Control Zones	255
Special Systems	Computer Air Conditioning, Glycol overhang heating.

12. ELECTPICAL

1. Substation

- Characteristics of Primary Voltage	14,200
- Characteristics of Secondary Voltage	600 and 120/208
- KVA Rating/Cross Area Sq. Ft. ...	6.7 Watts/Sq. Ft.
- Primary Protection	Load break switch
- Secondary Protection	Breakers
- Main Distribution Board	Molded Case

2. Distribution

- Related to Type of Structure ...	Mixed
- Voltage of Main Distribution (Secondary)	600
- Transformation to 120/208V	Scattered

3. Lighting

- Average Intensity of General Lighting in F.C.	70
- Average Cost of General Lighting Fixtures	$40.00

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12. ELECTRICAL (cont'd.)

3. Lighting (cont'd.)

- Branch Circuit Characteristics ..	EMT and L/X
- Switching	Local switching and some L.V. switching

4. Motors

- Motor Control Centres	Included
- Base Building Facilities	Air Conditioning

5. Fire Alarm

- Requirements	Minimum
- Smoke Detection	Minimum

6. Clocks

- Average Number Clocks	1:2,530 Sq. Ft.

7. Telephone

- Average Number Telephones	1:1,700 Sq. Ft.

8. T.V.

- Characteristics	Empty conduit network.

9. Special Requirements of Typical Occupancy

- Office and Classroom Sq. Ft. ...	69%/GFA
- Computer Sq. Ft.	19% GFA

ENGINEERING IV BUILDING, WATERLOO

Project: WATERLOO 35 - ENGINEERING IV
COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASIS

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		470,000		2.75	7.5
2	SUBSTRUCTURE	69,264	3.68	SF Grade Area		254,820		1.49	4.0
	a) Normal Foundations	1,763	131.23	CY Concrete	231,530		1.35		
	b) Basement Excavations	288,650	0.08	CF Basement Vol.	23,290		0.14		
	c) Special Foundations	-	-	-	-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	243,411	4.22	SF Struct. Area		1028,200		6.01	16.3
	a) Slabs on Grade	69,264	1.13	SF Slab Area	78,410		0.46		
	b) Floor & Roof Construction	174,147	4.76	SF Slab Area	828,420		4.84		
	c) Roof Finish	75,984	1.60	SF Roof Finish	121,430		0.71		
4	EXTERIOR CLADDING	144,462	5.77	SF Wall Area		833,230		4.88	13.3
	a) Walls below Grade	7,608	4.17	SF Wall Area	31,710		0.19		
	b) Walls above Grade	106,650	5.14	SF Wall Area	548,100		3.20		
	c) Windows	20,000	11.00	SF Window Area	220,000		1.29		
	d) Exterior Doors, Entrances, Screen	1,205	6.95	SF Opening Area	8,380		0.05		
	e) Projections, Balconies, Etc.	8,990	2.75	SF Soffit	25,040		0.15		
5	INTERIOR VERTICAL ELEMENTS	170,273	2.63	SF Part. Area		447,800		2.62	7.1
	a) Partitions	156,224	2.24	SF Part. Area	350,150		2.05		
	b) Folding or ~~Sliding~~ Partitions	1,440	10.00	SF Part. Area	14,400		0.08		
	c) Doors	467	178.26	Per Door Leaf	83,250		0.49		

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Project: WATERLOO 35 - ENGINEERING IV
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		100,170		0.53	1.6
	a) Stairs, Steps & Ladders	21	1675	Per Flight	35,170		0.21		
	b) Catwalks, Gratings	2,600	5.00	SF on Plan	13,000		0.08		
	c) Elevators & Hoists	8	6500	Per Stop	52,000		0.30		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		334,620		1.76	5.3
	a) Floor Finishes	170,000	0.85	SF Finished Area	144,770		0.85		
	b) Ceiling Finishes	148,000	0.94	SF Finished Area	138,510		0.81		
	c) Wall Finishes	102,000	0.50	SF Fin. Wall Area	51,340		0.30		
	d) Special Finishes	-	-	-	-		-		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		514,400		3.01	8.2
	a) Non Instructional	-	-	-	151,300		0.89		
	b) Instructional	-	-	-	363,100		2.12		
9	CASH ALLOWANCES	-	-	-		110,000		0.65	1.8
	a) Hardware	512	185.00	Per Unit	95,000		0.56		
	b) Tests and Inspections				15,000		0.09		

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Project: WATERLOO 35 - ENGINEERING IV
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		315,000		1.84	5.0
	a) Roughing-In (Standard)	86	1100	Per Fixture	94,500		0.55		
	b) Roughing-In (Special)	98	388	Per Fixture	38,000		0.22		
	c) Plumbing Fixtures (Standard)	86	238	Per Fixture	20,500		0.12		
	d) Plumbing Fixtures (Special)	13	154	Per Fixture	2,000		0.01		
	e) Fire Protection	22	1140	Per Cabinet	25,000		0.15		
	f) Special Services			-	135,000		0.79		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		1,050,000		6.14	16.7
	a) HVAC	-	-	-	910,000		5.32		
	b) Special Systems	-	-	-	140,000		0.82		
12	ELECTRICAL	-	-	-		831,000		4.86	13.2
	a) Transformers & Distribution	-	-	-	66,800		0.39		
	b) Lighting Fixtures & Branch Wiring	-	-	-	314,000		1.84		
	c) Underfloor Duct Systems	-	-	-	39,250		0.23		
	d) Special Systems	-	-	-	410,950		2.40		
						6,289,300	*	36.80	100
	Federal Sales Tax Rebate - 3%					(188,700)		(1.10)	
						6,100,600		35.70	

* $62.33 / NASF

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Project: WA. 35 - ENGINEERING IV
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid)		$ 6,344,000
	DEDUCTIONS:		
	1. 100% to 50% Performance Bond (low bid)	$ 6,100	
	2. Critical Path Scheduling (low bid)	19,000	
	3. Contingencies (Spec'd. Allnce)	63,850	
	4. Demolitions (low bid)	5,000	
	5. Exterior Works (low bids)	44,448	
	6. Equipment (low bids)	39,501	
	7. Pedestrian Overpass (low bid)	155,156	
	8. Alterations (low bids)	289,100	
	9. Utilities & Sitework (low bids)	35,625	657,780
			$ 5,686,220
	10. Federal Sales Tax		170,600
B)	ADJUSTED BUILDING CONTRACT COST AT MARCH, 1970		$ 5,515,620
C)	BUILDING CONTRACT COST AT SEPTEMBER, 1971 PER COST ANALYSIS		6,100,600
D)	COST INCREASE - MARCH 1970 TO SEPTEMBER 1971		$ 584,980

The above reflects an increase, or escalation factor of 10.6% of adjusted original low bid amount.

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Project: WATERLOO 35 - ENGINEERING IV
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	170,900 S.F.						
Net Assignable Floor Area	100,900 S.F.						
Cubic Volume	2,505,000 C.F.						
Net Assignable Floor Area/Gross Floor Area	0.59:1 Ratio						
Exterior Wall Area/Gross Floor Area	0.79:1 Ratio						
Roof Area/Gross Floor Area	0.44:1 Ratio						
Volume/Gross Floor Area	14.66:1 Ratio						
Floors at and above Grade .....)	Mixed	1	2	1	2	4	No.
Floors below Grade .....)		0	0	1	1	0	No.

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Project: WATERLOO 35 - ENGINEERING IV
PERFORMANCE & STATISTICAL DATA

Sheet No: 6

1. INDIRECT & GENERAL EXPENSES

Construction Period	17 Months
Winter Construction Period	6 Months
Performance Bond	100%
Fire Insurance by Owner	Yes
Market Conditions	Slack (5 bids, range 4%)

2. SUBSTRUCTURE

Type of Soil	Poor - brown and gray silts with some clay
Watertable	Ground water seepage - erratic, average 5' to 6'
Bearing Capacity of Soil	3,000 to 6,000 lbs/Sq.Ft.
Slope of Site	0.02%

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structural Type .....)	Structural steel frame, OWSJ, steel deck and
Material .....)	metal pans, concrete topping, all fireproofed.
Shear Structure	None
Structural Bay Sizes	Extremely varied- 21'6" x 40'0" to 10'0" x 20'0"
Floor to Floor Heights	Average 12' 5"
Structural Depth	Average 18"
Floor Live Loading	Generally 85 lbs./Sq.Ft
Roof Live Loading	40 lbs./Sq.Ft.

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3.(c) ROOF FINISH

Roof Finish Type	4 ply felt and asphalt; gravel surfacing; vapour barrier; 1-1/2" insulation; painted galvanized iron flashings.
Rooflights	0.007%
Perimeter/Roof Area	1:19 Ratio
"U" Factor	0.14

4. EXTERIOR CLADDING

%Total Sq. Ft. Glazed (of walls above grade)	16.5%
% Glazed Area Openable	Nil
Sun Control Measures	Tinted glass
Wall Thickness	18" 16" 14" 12" 6"
Unglazed "U" Factor	Average 0.14
Inside Face Material	Smooth faced clay tile, concrete block
Exterior Face Material	Precast concrete broken ribbed, brick,
Exterior Finish	metal louvres
Window Type	Thermal broken aluminum, Hardcolour finish
Glazing Type	Double, single in some corridor areas.

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Project: WATERLOO 35 - ENGINEERING IV
PERFORMANCE & STATISTICAL DATA

Sheet No: 8

5. INTERIOR VERTICAL ELEMENTS

Linear Ft. Partitions/Gross Floor Area ..... 1:12:39 Ratio

Partition Types	Type	% Area	Height
- Structural (Load-bearing)	Concrete	0.52	11' 0"
- Replaceable	Clay tile	61.	Av. 12' 0"
.....	Brick	4.	12' 0"
.....	Clay tile and brick	6.	12' 0"
.....	Glazed	5.	Av. 8' 0"
.....	St. Stud and Drywall	12.	9"0" and 12'0"
- Demountable	Steel panel	10.5	9' 0"
- Folding	Vinyl covered steel	1.	9' 0"
		100%	

Door Types ..... Hollow metal, solid core wood, plastic laminate, some having glazed panels. 1 special radiation door.

Doors Ratio ..... 3.38 per 100 Lin.Ft. Partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Concrete filled steel pan, steel ladders.

Elevator Types ..... Hydraulic - 2 No. 3500# passenger, 200 FPM., 4 floors, 4 openings.

Hoist Types ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally 1/8 vinyl asbestos tile, carpet, quarry tile, traprock, epoxy paint, ceramic tile, sealed concrete.

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7. INTERIOR FINISHES (Cont'd.)

Ceilings	Generally suspended perforated metal acoustic system; suspended lay-in acoustic tile, suspended painted drywall, unfinished exposed fireproofing, painted exposed concrete, porcelain enamel panel.
Walls	Generally untreated clay tile, painted concrete block, painted drywall, ceramic tile, rubbed concrete.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, shelving, coat closets and cupboards, lockers, monorail and cranes, miscellaneous metal items.
(b) Instructional	Laboratory furniture, chalk and tack boards, steel pedestal floating floor, projection screens.

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Stainless Steel
(b) Inspection and Testing	Soil and fill compaction, concrete, structural steel, roofing, precast concrete.

Project: WATERLOO 35 - ENGINEERING IV
PERFORMANCE & STATISTICAL DATA

Sheet No: 10

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type U copper
Sanitary Soil Piping Type	Cast iron
Sanitary Waste, Ventilating Piping Type	DWV copper
Special Piping Type	Polypropylene, UPVC.
Plumbing Fixtures Density per 1000 S.F.	.5
Special Services	de-ionized water, vacuum 9 as compressed air , acid drainage, hydraulic oil.

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	100%
Heating Source	Remote
Fuel	Gas
Cooling Source	Remote
Air Handling Source	Building
Capacities Heating	17,348,000 BTU/HR
Capacity Cooling	671 tons
Air Handling CFM	226,280 CFM
Heating Ratio	101.5 BTU/HR per G.S.F.
Cooling Ratio	3.9 tons per 1000 G.S.F.
Ventilation Ratio	1.33 C.F.M. per sq. ft.
% Return Air	75%

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11. HEATING, VENTILATING, AIR CONDITIONING (HVAC) (contd.)

% Main Exhaust	25%
Thermostats per 1000 G.S.F.	0.7 No.
Control Zones	72 No.
Special Systems	Fume hood exhaust ducts and fans, make-up air to laboratories, special exhaust hoods, computer air conditioning.

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage	14.2 kv
Characteristics of Secondary Voltage	347/600 kv
- KVA Rating/Gross Area Sq.Ft.....	11.8 Watts/Sq.Ft.
- Primary Protection	Load Break Switch
- Secondary Protection	Breaker
- Main Distribution Board	Molded Case

2. Distribution

- Related to Type of Structure ...	Horizontal
- Voltage of Main Distribution ...	347/600
- Transformation to 120/208V	Scattered

3. Lighting

- Average Intensity of General Lighting in F.C.	3.5 Watts/Sq. Ft.

12. ELECTRICAL (cont'd.)

- Average cost of General Lighting Fixtures $25.00
- Branch Circuit Characteristics .. Galvanized
- Switching ..... Local switching and some low voltage switching

4. Motors
   - Motor Control Centres ..... Included
   - Base Building Facilities ..... Air Conditioning

5. Fire Alarm
   - Requirements ..... Heavy
   - Smoke Detection ..... Minimum

6. Clocks
   - Average Number Clocks ..... 1:3,400 Sq. Ft.

7. Telephone
   - Average Number Telephones ..... 1:2,000 Sq. Ft.

8. T.V.
   - Characteristics ..... Empty Conduit Network

9. Special Requirements of Typical Occupancy
   - Laboratory ..... 62.6%Sq. Ft./O.G.S.F.

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NORTHERN ELECTRIC, TORONTO

Project: NORTHERN ELECTRIC - TORONTO BRANCH LABORATORY
COST ANALYSIS — ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		160,000		1.77	7.3
2	SUBSTRUCTURE	53,184	0.88	SF Grade Area		46,940		0.52	2.1
	a) Normal Foundations	419	112.00	CY Concrete	46,940		0.52		
	b) Basement Excavations	-	-	CF Basement Vol.	-		-		
	c) Special Foundations	-	-		-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	146,574	2.50	SF Struct. Area		399,180		4.43	18.4
	a) Slabs on Grade	53,184	1.02	SF Slab Area	54,380		0.60		
	b) Floor & Roof Construction	93,390	2.61	SF Slab Area	239,500		2.66		
	c) Roof Finish	53,184	1.98	SF Roof Finish	105,300		1.17		
4	EXTERIOR CLADDING	40,766	4.82	SF Wall Area		196,650		2.18	9.0
	a) Walls below Grade	-	-	SF Wall Area	-		-		
	b) Walls above Grade	33,753	4.23	SF Wall Area	142,920		1.59		
	c) Windows, Entrances, Screens	3,420	12.00	SF Window Area	41,040		0.45		
	d) Exterior Doors, ~~Entrances, Screen~~	350	8.45	SF Opening Area	2,960		0.03		
	e) Projections, Balconies, Etc.	3,243	3.00	SF Soffit Area	9,730		0.10		
5	INTERIOR VERTICAL ELEMENTS	36,126	2.65	SF Part. Area		98,020		1.07	4.4
	a) Partitions	33,756	2.48	SF Part. Area	83,830		0.93		
	b) Folding or Sliding Partitions	-	-	SF Part. Area	-		-		
	c) Doors	79	154.30	Per Door Leaf	12,190		0.14		

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Project: NORTHERN ELECTRIC - TORONTO BRANCH LABORATORY
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		23,640		0.26	1.1
	a) Stairs, Steps & Ladders	3	2536	Per Flight	7,700		0.09		
	b) Catwalks, Gratings	-	-	SF on Plan	-		-		
	c) Elevators & Hoists	2	7925	Per Stop	15,850		0.17		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		223,690		2.48	10.3
	a) Floor Finishes	90,147	0.49	SF Finished Area	44,160		0.49		
	b) Ceiling Finishes	90,147	1.50	SF Finished Area	135,480		1.50		
	c) Wall Finishes	58,152	0.64	SF Fin. Wall Area	37,240		0.41		
	d) Special Finishes	2,270	3.00	SF Fin. Col. Area	6,810		0.08		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		27,380		0.30	1.2
	a) Non Instructional	-	-	-	27,380		0.30		
	b) Instructional	-	-	-	-		-		
9	CASH ALLOWANCES	-	-	-		13,500		0.15	0.6
	a) Hardware	90	150	Per Unit	13,500		0.15		
	b)	-	-	-	-		-		

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Project: NORTHERN ELECTRIC - TORONTO BRANCH LABORATORY
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		108,000		1.20	5.0
	a) Roughing-In (Standard)	61	968	Per Fixture	59,000		0.66		
	b) Roughing-In (Special)	-	-	Per Fixture	-		-		
	c) Plumbing Fixtures (Standard)	53	208	Per Fixture	11,000		0.12		
	d) Plumbing Fixtures (Special)	-	-	Per Fixture	-		-		
	e) Fire Protection	711	53	Per Cabinet or Per Head	38,000		0.42		
	f) Special Services	-	-	Per Outlet	-		-		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		540,000		6.00	24.8
	a) HVAC	-	-	-	540,000		6.00		
	b) Special Systems	-	-	-	-		-		
12	ELECTRICAL	-	-	-		340,800		3.78	15.7
	a) Transformers & Distribution	-	-	-	157,700		1.75		
	b) Lighting Fixtures & Branch Wiring	-	-	-	108,000		1.20		
	c) Underfloor Duct Systems	-	-	-	32,400		0.36		
	d) Special Systems	-	-	-	42,700		0.47		
						2,175,800		24.14	100

$32.56 / NASF

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Project: NORTHERN ELECTRIC - TORONTO BRANCH LABORATORY
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (LOW BID)		$ 1,982,000
	DEDUCTIONS		
	1. General Sitework (Low Bids)	$ 43,800	
	2. Asphalt Roads and Curbs (Low Bids)	51,900	
	3. Landscaping and P.C. Paving (Low Bids) ...	37,800	
	4. Mechanical and Electrical Services (Low Bids)	65,000	
	5. Exterior Lighting (Low Bid)	10,500	209,000
B)	ADJUSTED BUILDING COST AT MARCH, 1967		$ 1,773,000
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 Per Cost Analysis		2,175,800
D)	COST INCREASE MARCH 1967 TO SEPTEMBER 1971		$ 402,800

The above reflects an increase, or escalation factor, of 22.7% of adjusted low bid amount.

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Project: NORTHERN ELECTRIC - TORONTO BRANCH LABORATORY
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	90,147 sq. ft.
Net Assignable Floor Area	66,820 sq. ft.
Cubic Volume	1,329,125 cu. ft.
Net Assignable Floor Area/Gross Floor Area	0.74:1 Ratio
Exterior Wall Area/Gross Floor Area .	0.42:1 Ratio
Roof Area/Gross Floor Area	0.59:1 Ratio
Volume/Gross Floor Area	14.74:1 Ratio
Floors At and Above Grade	2 No.
Floors Below Grade	- No.

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1. INDIRECT & GENERAL EXPENSES

Construction Period	11 Months
Winter Construction Period	4 Months
Performance Bond	Nil
Fire Insurance by Owner	Yes
Market Conditions	Busy (9 Bids, range 14%)

2. SUBSTRUCTURE

Type of Soil	Sandy gravelly clay
Watertable	2 to 5 feet below grade
Bearing Capacity of Soil	4000 lbs./Sq. Ft.
Slope of Site	2.5%

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structure Type and Material	Structural steel frame. First floor - composite steel deck and concrete fill. Roof - steel deck.
Shear Structure	-
Structural Bay Sizes	30' 0" x 30' 0"
Floor to Floor Heights	14'8" and 14'0"
Structural Depth	1'6"
Floor Live Loading	100/125 lbs./Sq. Ft.
Roof Live Loading	40 lbs./Sq. Ft.

Project: NORTHERN ELECTRIC - TORONTO BRANCH LABORATORY
PERFORMANCE & STATISTICAL DATA

Sheet No: 7

3.(c) ROOF FINISH

Roof Finish Type	4 ply built up felt and pitch, double gravel surfacing, vapour barrier, 1-1/2" rigid insulation, lead covered copper flashings throughout.
Rooflights	0.10%
Perimeter/Roof Area	1:33 Ratio
"U" Factor	0.14

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (Above Grade).	10.7%
% Glazed Area Openable	Nil
Sun Control Measures	Solar Grey Glass
Wall Thickness	12", 8"
Unglazed "U" Factor	0.14
Inside Face Material and Finish	Brick, Silicone W.P. finish
Window Type	Aluminum, Permanodic finish
Glazing Type	Single

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area ..... 1:38.49 Ratio

Partition Types	Type	% Area	Height
- Structural (load-bearing)	Brick and concrete block	14%	14'0" av.

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partition Types (cont'd.)

	Type	% Area	Height
- Perlaccable	Concrete Block	30%	14'0" av.
.....	Brick and concrete block	50%	14'0" av.
		100%	

Doors Type ..... Birch veneered solid core wood slab, hollow metal slab - generally all with transom panels, some with glazed panels, pressed steel frames.

Doors Ratio ..... 3.5 per 100 Lin. Ft. partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Concrete: (a) with quarry tile finish; (b) with exposed concrete finish

Elevator Types ..... Hydraulic 4500# freight, 20 FPM up and 30 FPM down, 2 floors, 3 stops.

Hoist Types ..... None

7. INTERIOR FINISHES

Floors ..... Generally 1/8" vinyl asbestos tile, sealed and hardened exposed concrete, quarry tile, ceramic tile.

Ceilings ..... Generally suspended "Soundlock" metal acoustic panel "Luxacon" aluminum acoustic slat, suspended lath and plaster painted, wood strip, painted steel deck.

Walls ..... Generally painted block, painted plaster, epoxy painted block, ceramic tile.(N.B. large proportion facebrick finished partitions).

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8. FITTINGS, FIXTURES AND EQUIPMENT

(a) Non-Instructional	Washroom accessories, counters, shelving, vanities, miscellaneous metal items.

9. CASH ALLOWANCES

(a) Finishing Hardware

- Type .....
- Finish .....

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type L copper and galvanized steel
Sanitary Soil Piping Type	Cast iron
Sanitary Waste, Ventilating Piping Type	Galvanized steel and Type K copper
Special Piping Type	None
Plumbing Fixtures Density per 1000 S.F.	0.63 No.
Special Services	None

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	100%
Heating Source	Remote

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC) (cont'd.)

Fuel	Oil
Cooling Source	Building
Air Handling Source	Building
Capacities Heating	1,315,000 BTU/HR
Cooling Capacity	300 tons
Air Handling CFM	152,800 CFM
Heating Ratio	14.6 BTU/HR per sq. ft.
Cooling Ratio	4.4 tons per 1000 G.S.F.
Ventilation Ratio	1.59 CFM per sq. ft.
% Return Air	90%
% Main Exhaust	2%
Thermostats per 1000 GSF	0.24
Control Zones	4

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage	21 kv/4kv
- Characteristics of Secondary Voltage	4000/277-480v
- KVA Rating/Gross Area S.F.	4 watts/Sq. Ft.
- Primary Protection	Load Break switch
- Secondary Protection	Fuse

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12. ELECTRICAL (cont'd.)

1. Substation (cont'd.)
   - Main Distribution Board ..... Fuses

2. Distribution
   - Related to Type of Structure .. Horizontal
   - Voltage of Main Distribution .. 277/480
   - Transformation to 120/208V ... Scattered

3. Lighting
   - Average Intensity of General Lighting in F.C. 5
   - Average Cost of General Lighting Fixtures $30.00
   - Branch Circuit Characteristics. EMT
   - Switching ..... Panel Switching

4. Motors
   - Motor Control Centres ..... Included
   - Base Building Facilities ..... Air Conditioning

5. Fire Alarm
   - Requirements ..... Minimum

6. Clocks
   - Average Number Clocks ..... Negligible

7. Telephone
   - Average Number Telephones .... Negligible

12. ELECTRICAL (cont'd.)

8. T.V.

- Characteristics ..... } Close Cct. System - None
..... } Empty Conduit Network - None

9. Special Requirements of Typical Occupancy

- The normal electrical cost for this building in 1971 would be $270,800.
- In the present case, however, primary voltage was supplied at 21 kv, thus necessitating an outdoor substation and expensive cabling not usually associated with this type of building.

The cost of this special requirement is estimated at $70,000.

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SYSTEMS DIMENSIONS LIMITED, OTTAWA

Project: SDL BUILDING, OTTAWA
COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		181,000		1.78	7.9
2	SUBSTRUCTURE	35,673	0.69	SF Grade Area		24,440		0.24	1.1
	a) Normal Foundations	287	60.76	CY Concrete	17,440		0.17		
	b) Basement Excavations	70,200	0.10	CF Basement Vol.	7,000		0.07		
	c) Special Foundations	-	-		-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	103,120	3.93	SF Struct. Area		405,660		3.98	17.5
	a) Slabs on Grade	35,673	0.94	SF Slab Area	33,670		0.33		
	b) Floor & Roof Construction	67,447	5.07	SF Slab Area	341,990		3.32		
	c) Roof Finish	37,805	0.79	SF Roof Finish	30,000		0.29		
4	EXTERIOR CLADDING	49,404	4.62	SF Wall Area		228,810		2.22	9.9
	a) Walls below Grade	18,233	3.70	SF Wall Area	67,460		0.66		
	b) Walls above Grade	33,987	2.14	SF Wall Area	72,530		0.70		
	c) Windows	5,837	10.44	SF Window Area	60,950		0.59		
	d) Exterior Doors, Entrances, Screen	1,049	18.11	SF Opening Area	19,000		0.18		
	e) Projections, Balconies, Etc.	1,900	4.67	SF Canopy Area	8,870		0.09		
5	INTERIOR VERTICAL ELEMENTS	52,063	2.07	SF Part. Area	-	142,760		1.39	6.2
	a) Partitions	48,557	2.39	SF Part. Area	116,170		1.13		
	b) Folding or Sliding Partitions	596	9.73	SF Part. Area	5,800		0.06		
	c) Doors	97	214.33	Per Door Leaf	20,790		0.20		

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Project: S.D.L. BUILDING - OTTAWA
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / GSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		56,600		0.55	2.4
	a) Stairs, Steps & Ladders	24	1820	Per Flight	25,600		0.25		
	b) Catwalks, Gratings	-	-	SF on Plan	-		-		
	c) Elevators & Hoists	6	5100	Per Stop	31,000		0.30		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		198,700		1.93	8.5
	a) Floor Finishes	99,170	0.67	SF Finished Area	66,700		0.65		
	b) Ceiling Finishes	99,170	0.71	SF Finished Area	69,900		0.68		
	c) Wall Finishes	8,742	0.40	SF Fin. Wall Area	62,100		0.60		
	d) Special Finishes	-	-	-	-		-		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		105,470		1.02	4.5
	a) Non Instructional	-	-	-	14,860		0.14		
	b) Instructional	-	-	-	90,610		0.88		
9	CASH ALLOWANCES	-	-	-		26,500		0.26	1.1
	a) Hardware	117	200.00	Per Unit	23,500		0.23		
	b) Inspection and Testing	-	-	-	3,000		0.03		

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Project: S.D.L. - OTTAWA
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		85,000		0.83	3.7
	a) Roughing-In (Standard)	70	857	Per Fixture	60,000		0.58		
	b) Roughing-In (Special)	-	-	Per Fixture	-		-		
	c) Plumbing Fixtures (Standard)	70	214	Per Fixture	15,000		0.15		
	d) Plumbing Fixtures (Special)	-	-	Per Fixture	-		-		
	e) Fire Protection	2	1500	Per Cabinet or	3,000		0.03		
	f) Special Services	84	83	Per Head Per Outlet	7,000		0.07		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		550,000		5.34	23.6
	a) HVAC	-	-	-	425,000		4.12		
	b) Special Systems Computer A/C	-	-	-	125,000		1.22		
12	ELECTRICAL	-	-	-		319,000		3.10	13.7
	a) Transformers & Distribution	-	-	-	157,600		1.53		
	b) Lighting Fixtures & Branch Wiring	-	-	-	99,000		0.96		
	c) Underfloor Duct Systems	-	-	-	-		-		
	d) Special Systems	-	-	-	62,400		0.61		
						$ 2,314,030		22.58	100

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$29.17 / NASF

Project: S.D.L. BUILDING - OTTAWA
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (LOW BID)		$ 2,047,770
	DEDUCTIONS:		
	1. Exterior Services (Low Bids).....	$ 19,170	
	2. Landscaping (Low Bid)	4,000	
	3. Asphalt Roadways (Low Bids)	32,000	
	4. Miscellaneous Sitework and Concrete Paving etc. (Low Bids)	11,420	66,670
B)	ADJUSTED BUILDING CONTRACT COST AT JANUARY 1969		$ 1,981,100
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS		2,324,030
D)	COST INCREASE - JANUARY 1969 to SEPTEMBER 1971		$ 342,930

The above reflects an increase, or escalation factor, of 17.3% of adjusted original low bid amount.

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Project: S.D.L. BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	* 102,930 Sq. Ft.
Net Assignable Floor Area	* 79,323 Sq. Ft.
Cubic Volume	1,407,220 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.77:1 Ratio
Exterior Wall Area/Gross Floor Area .	0.48:1 Ratio
Roof Area/Gross Floor Area	0.37:1 Ratio
Volume/Gross Floor Area	13.67:1 Ratio
Floors At and Above Grade	2 No.
Floors Below Grade	1 No.

* Includes approximately 16,500 square feet of indoor at grade basement level parking.

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Project: S.D.L. BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Sheet No: 6

1. INDIRECT & GENERAL EXPENSES

Construction Period	6 Months
Winter Construction Period	4-1/2 Months
Performance Bond	50% (plus 50% labour and material payment bond)
Fire Insurance by Owner	No
Market Conditions	Average (2 bids, range)

2. SUBSTRUCTURE:

Type of Soil	Rock
Watertable	N/A
Bearing Capacity of Soil	N/A
Slope of Site	Nil

3. (b)HORIZONTAL STRUCTURAL ELEMENTS

Structure Type and Material	Structural steel frame, steel deck, concrete topping.
Shear Structure	None
Structural Bay Sizes	29' x 28'
Floor to Floor Heights	13'0"
Structural Depth	(33% - 27" (67% - 30"
Floor Live Loading	100 lbs./Sq. Ft.
Roof Live Loading	40 lbs./Sq. Ft.

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3.(c) ROOF FINISH

Roof Finish Type	4 ply built-up felt and asphalt, gravel surfacing, 2" rigid insulation, extruded aluminum flashings anodized finish.
Rooflights	Nil
Perimeter/Roof Area	.04:1 Ratio
"U" Factor	0.14

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (Above Grade)	14%
% Glazed Area Openable	Nil
Sun Control Measures	Tinted Glass
Wall Thickness	0' 9"
Unglazed "U" Factor	0.13
Inside Face Material	Gypsum Board
Exterior Face Material and Finish ..	Brick face, exposed concrete sandblasted, exposed structural steel painted, metal louvres.
Window Type	Aluminum fixed with permanodil bronze hardcoat finish.
Glazing Type	78% Double - 22% triple, hermetically sealed units.

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area	1:23.7 Ratio

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partitition Types	Type	% Area	Height
- Structural (Load-Bearing)	Concrete	11%	9'6"
- Replaceable .....)	Concrete block	13%	11'8" and 13'0"
.....)	Aluminum glazed	9%	9'3" and 25'0"
.....)	Brick	5%	9'6"
.....)	Steel stud and plaster	54%	8'6", 9'6" and 18'0"
- Demountable	Vinyl clad panels, aluminum frames	8%	'0" and 9'6"
		100%	

Doors Types ..... Walnut veneered solid core wood, matching transom panels, pressed steel frames.

Doors Patio ..... 1.97 per 100 Lin. Ft. Partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Concrete filled steel pan

Elevator Types ..... Hydraulic 1 No.2500 passenger, 85 FPM up and 115 FPM down, 3 floors, 4 openings. Electric traction 1 No. 250# dumbwaiter, 50 FPM, 3 floors, 3 openings.

Hoist Types ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally carpet. 1/8" vinyl asbestos tile, 1-1/2" terrazo, ceramic tile, hardened concrete.

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7. INTERIOR FINISH (cont'd.)

Ceilings	Generally suspended lay-in acoustical tile, suspended 1/2" drywall painted, painted steel deck.
Walls	Generally painted plaster, vinyl fabric, ceramic tile.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, millwork, shelving, miscellaneous specialties.
(b) Instructional	Steel panel pedestal computer floor, sliding chalkboard units.

9. CASH ALLOWANCES

(a) Finishing Hardware

- Type	Standard
- Finish	Stainless steel

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type L Copper
Sanitary Soil Piping Type	Cast iron
Sanitary Waste, Ventilating Piping Type	Type DWV Copper
Special Piping Type	None
Plumbing Fixtures Density per 1000 S.F.	.70

10. PLUMBING & DRAINS (cont'd.)

Special Services	None

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	65%
Heating Source	Building
Fuel	Gas
Cooling Source	Building
Air Handling Source	Building
Capacities Heating	6,700,000 BTU/HR
Cooling Capacity	265 tons
Air Handling CFM	99,500 CFM
Heating Ratio	65.00 BTU/HR/SF
Cooling Ratio	2.57 tons per 1000 GSF
Ventilation Ratio	0.97 CFM/SF
% Return Air	78%
% Main Exhaust	22%
Thermostats per 1000 GSF	.02
Control Zones	None
Special Systems	Computer Air Conditioning

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage	13 kv
- KVA Rating/Gross Area Sq. Ft. ...	Not available - See * below
- Primary Protection	Load Break Switch - breakers.
- Secondary Protection	Breaker
- Main Distribution Board	Cordon type
*Transformers supplied by others .	Vault construction

2. Distribution

- Related to Type of Structure ...	Mixed
- Voltage of Main Distribution ...	120/208 and 347/600v
- Transformation to 120/208v	Central

3. Lighting

- Average Intensity of General Lighting in F.C.	70 F.C.
- Average Cost of General Lighting Fixtures	$35.00
- Branch Circuit Characteristics .	Galvanized
- Switching	Local switching

4. Motors

- Motor Control Centres	Included
- Base Building Facilities	Air Conditioning

Project: S.D.L. BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Sheet No: 12.

12. ELECTRICAL (cont'd.)

5. Fire Alarm

- Requirements	Minimum
- Smoke Detection	Minimum

6. CLOCKS

- Average Number Clocks	Minimum

7. TELEPHONE

- Average Number Telephones ...	Minimum

8. T.V.

- Characteristics	None

9. SPECIAL REQUIREMENTS OF TYPICAL OCCUPANCY

- Some Heaters	Approx . $8,000
- Car Parking Heaters	Approx. $0,000
- Frost Protection	Approx. $2,000
- Outdoor Lighting	Approx. $7,500
- Kitchen	Approx. $2,000
- Lighting Fixtures were 2' x 4' Air Handling	
- Remote Substation from Building	
- Computer Distribution Fairly Heavy	

VARETTE OFFICE BUILDING, OTTAWA

Project: VARETTE OFFICE BUILDING
COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		327,000		1.06	7.2
2	SUBSTRUCTURE	21,389	4.79	SF Grade Area		102,550		0.32	2.2
	a) Normal Foundations	419	53.10	CY Concrete	22,250		0.07		
	b) Basement Excavations	845,310	0.09	CF Basement Excav. Vol.	80,300		0.25		
	c) Special Foundations	-	-		-				
3	HORIZONTAL STRUCTURAL ELEMENTS	317,084	2.03	SF Struct. Area		645,730		2.03	13.8
	a) Slabs on Grade	21,389	0.95	SF Slab Area	20,320		0.06		
	b) Floor & Roof Construction	296,595	2.02	SF Slab Area	600,200		1.89		
	c) Roof Finish	14,753	1.70	SF Roof Finish	25,210		0.08		
4	EXTERIOR CLADDING	117,330	5.92	SF Wall Area		695,230		2.19	14.9
	a) Walls below Grade	21,803	3.32	SF Wall Area	72,280		0.23		
	b) Walls above Grade	75,454	6.52	SF Wall Area	492,430		1.55		
	c) Windows	17,577	4.75	SF Window Area	83,490		0.26		
	d) Exterior Doors, Entrances, Screen	2,496	18.84	SF Opening Area	47,030		0.15		
	e) Projections, Balconies, Etc.	-	-		-		-		
5	INTERIOR VERTICAL ELEMENTS	100,137	2.22	SF Part. Area		222,830		0.70	4.8
	a) Partitions (Incl. Shear Walls)	95,674	1.85	SF Part. Area	177,550		0.56		
	b) Folding or Sliding Partitions	-	-	SF Part. Area	-		-		
	c) Doors	203	223	Per Door Leaf	45,280		0.14		

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Project: VARSITY OFFICE BUILDING
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / GRSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		318,250		1.58	11.1
	a) Stairs, Steps & Ladders	46	1157	Per Flight	53,250		0.17		
	b) Catwalks, Gratings	-	-	SF on Plan	-		-		
	c) Elevators & Hoists	101	4500	Per Stop	465,000		1.46		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-	-	570,300		1.69	12.0
	a) Floor Finishes	296,600	0.95	SF Finished Area	282,540		0.89		
	b) Ceiling Finishes	246,700	0.52	SF Finished Area	128,130		0.41		
	c) Wall Finishes	249,620	0.68	SF Fin. Wall Area	169,630		0.53		
	d) Special Finishes	-	-	-	-		-		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		32,600		0.10	0.7
	a) Non Instructional	-	-	-	32,600		0.10		
	b) Instructional	-	-	-	-		-		
9	CASH ALLOWANCES	-	-	-		10,500		0.03	0.2
	a) Hardware	220	75.00	Per Unit	16,500		0.05		
	b) -	-	-	-	-	-	-		

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Project: VARETTE OFFICE BUILDING
COST ANALYSIS - ALL COSTS AT SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		241,000		0.70	5.2
	a) Roughing-In (Standard)	302	331	Per Fixture	100,000		0.31		
	b) Roughing-In (Special)	-	-	Per Fixture	-		-		
	c) Plumbing Fixtures (Standard)	302	199	Per Fixture	60,000		0.19		
	d) Plumbing Fixtures (Special)	-	-	Per Fixture	-		-		
	e) Fire Protection	52	788	Per Cabinet ~~xx~~	41,000		0.13		
		795	50	Per Head	40,000		0.13		
	f) Special Services	-	-	Per Outlet	-		-		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		855,000		2.70	18.3
	a) HVAC	-	-	-	855,000		2.69		
	b) Special Systems	-	-	-	-		-		
12	ELECTRICAL	-	-	-		430,000		1.36	9.2
	a) Transformers & Distribution	-	-	-	103,000		0.32		
	b) Lighting Fixtures & Branch Wiring	-	-	-	276,000		0.87		
	c) Underfloor Duct Systems	-	-	-	8,000		0.03		
	d) Special Systems	-	-	-	43,000		0.14		
						$ 4,675,000		14.73	100

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$16.61 / NASF

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Project:	VARETTE BUILDING - OTTAWA COST RECONCILIATION	Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid)	$ (Not Available)
	Note: The building owner has requested that the original complete building costs not be disclosed and this is respected. The adjusted building cost below does, however, parallel exactly our cost analysis.	
B)	ADJUSTED BUILDING CONTRACT COST AT MAY, 1969	3,900,150
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS	4,675,290
D)	COST INCREASE MAY 1969 TO SEPTEMBER 1971	$ 769,340

The above reflects an increase, or escalation factor, of 19.7% of Adjusted Building Contract Cost.

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Project: VARETTE OFFICE BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA

Gross Floor Area	317,400 Sq. Ft.*
Net Assignable Floor Area	281,569 Sq. Ft.* x
Cubic Volume	3,293,753 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	.89:1 Ratio
Exterior Wall/Gross Floor Area	.37:1 Ratio
Roof Area/Gross Floor Area	.05:1 Ratio
Volume/Gross Floor Area	10.38:1 Ratio
Floors At and Above Grade	19 No.
Floors Below Grade	4 No.

* Includes approximately 62,000 Square Feet of Indoor below-grade 4 level parking ramps.

x The lack of tenant partitioning information precluded the computation in the typical manner of the net assignable floor area of this building. The figure shown does not take into account eventual circulation, etc., space created by such partitioning and is therefore higher than the actual figure will be when the building is fully sub-divided. This fact must be borne in mind when examining cost figures related to this statistic.

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1. INDIRECT & GENERAL EXPENSES

Construction Period	16 Months
Winter Construction Period	4-1/2 Months
Performance Bond	None
Fire Insurance by Owner	Yes
Market Conditions	N/A (Owner Built)

2. SUBSTRUCTURE

Type of Soil	Rock
Watertable	
Bearing Capacity of Soil	
Slope of Site	Nil

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structure Type and Material	Reinforced concrete flat slab
Shear Structure	Reinforced concrete central core walls
Structural Bay Sizes	18' x 18'
Floor to Floor Heights	10' 5"
Structural Depth	Average 9-1/2"
Floor Live Loading	50 lbs./Sq. Ft.
Roof Live Loading	40 lbs. Sq. Ft.

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3.(c) ROOF FINISH

Roof Finish Type	4 ply built-up felt and asphalt, gravel surfacing, vapour barrier, 1-1/2" rigid insulation, galvanized flashings.
Rooflights	None
Perimeter/Roof Area	.03:1 Ratio
"U" Factor	0.145

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (above grade).	10%
% Glazed Area Openable	None
Sun Control Measures	Blinds
Wall Thickness	0'-11"
Unglazed "U" Factor	0.13
Inside Face Material	Plaster
Exterior Face Material and Finish ..	Precast concrete and brick
Window Type	Aluminum fixed, clear anodized finish (minimum quality.
Glazing Type	Single

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area	1:33.33

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partition Types	Type	% Area	Height
- Structural (Load-Bearing)	Concrete	36%	10'5"
- Replaceable	Concrete block	59%	7'4"; 8'8"; 10'4" and 12'6"
- Demountable	Metal glazed	3%	10'0" and 8'0"
- Sliding and Folding	Nil		
		100%	

Doors Types ..... Hollow metal slabs in pressed steel frames, some with glazed panels.

Doors Ratio ..... 2.19 per 100 Lin. Ft. Partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Reinforced concrete

Elevator Types ..... Electric traction - 5 No. 3500# passenger, 500 FPM, 4 serving 19 floors, 19 openings and 1 serving 20 floors, 20 openings.

Electric traction - 1 No. 7500# freight, 25 FPM serving 5 floors, 5 openings.

Hoist Types ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally carpet; hardened concrete in parking; ceramic tile, terrazzo sealed concrete.

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7. INTERIOR FINISHES (cont'd.)

Ceilings	Generally suspended lay-in acoustic tile, decorative ceiling in lobby.
Walls	Generally painted plaster, ceramic tile, marble in lobby.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, valances, directory board, plastic signs, mail chute and miscellaneous metal items.
(b) Instructional	Nil

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Brushed aluminum

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type K Copper
Sanitary Soil Piping Type	Cast iron
Sanitary Waste, Ventilating Piping Type	Type DWV Copper
Special Piping Type	None
Plumbing Fixtures Density per 1000 S.F.	0.95

10. PLUMBING AND DRAINS (cont'd.)

Special Services	None

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	67%
Heating Source	Building
Fuel	Oil and Gas
Cooling Source	Building
Air Handling Source	Building
Capacities Heating	8,368,000 BTU/HR
Cooling Capacity	500 tons
Air Handling CFM	129,900 CFM
Heating Ratio	28.4 BTU/HR per Sq. Ft.
Cooling Ratio	1.58 tons per 1000 GSF
Ventilation Ratio	0.41 CFM per Sq. Ft.
% Return Air	66%
% Main Exhaust	35%
Thermostats per 1000 GSF	1.4
Control Zones	5
Special Systems	None

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage 15 kv
- Characteristics of Secondary Voltage 120/208v
- KVA Rating/Cross Area Sq. Ft. ... 6.3
- Primary Protection ..... Breakers
- Secondary Protection ..... Breaker
- Main Distribution Board ..... Molded Case

2. Distribution

- Related to Type of Structure .... Vertical
- Voltage of Main Distribution 120/208v
- Transformation to 120/208v ..... Not applicable

3. Lighting

- Average Intensity of General Lighting in FC 70
- Average Cost of General Lighting Fixtures $18.00
- Branch Circuit Characteristics .. EMT; B/X
- Switching ..... Panel switching; local switching

4. Motors

- Motor Control Centres ..... Included
- Base Building Facilities ..... Air Conditioning

12. ELECTRICAL (cont'd.)

5. Fire Alarm

- Requirements ..... Minimum
- Smoke Detection .....

6. Clocks

- Average Number Clocks ..... Not Applicable

7. Telephone

- Average Number Telephones ..... Not Applicable

8. T.V.

- Characteristics ..... None

9. Special Requirements of Typical Occupancy .. Not Applicable

- Significant characteristic is the absence of underfloor duct system throughout the Building.

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GENERAL PURPOSE OFFICE BUILDING, OTTAWA

Project: GENERAL PURPOSE OFFICE BUILDING - OTTAWA
COST ANALYSIS — ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		487,000		1.13	6.6
2	SUBSTRUCTURE	20,433	2.55	SF Grade Area		52,220		0.12	0.7
	a) Normal Foundations	380	66.13	CY Concrete	25,130		0.06		
	b) Basement Excavations	263,381	0.10	CF Basement Vol.	27,090		0.06		
	c) Special Foundations	-	-		-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	451,535	2.29	SF Struct. Area		1032,490		2.38	14.0
	a) Slabs on Grade	20,433	1.50	SF Slab Area	30,600		0.07		
	b) Floor & Roof Construction	431,102	2.26	SF Slab Area	975,560		2.25		
	c) Roof Finish	18,125	1.45	SF Roof Finish	26,330		0.06		
4	EXTERIOR CLADDING	137,975	9.62	SF Wall Area		1328,300		3.06	17.8
	a) Walls below Grade	9,253	3.60	SF Wall Area	33,300		0.08		
	b) Walls above Grade	90,800	10.61	SF Wall Area	964,000		2.22		
	c) Windows	33,962	7.80	SF Window Area	265,000		0.61		
	d) Exterior Doors, Entrances, Screen	3,960	16.67	SF Opening Area	66,000		0.15		
	e) Projections, Balconies, Etc.	-	-		-		-		
5	INTERIOR VERTICAL ELEMENTS	147,060	2.35	SF Part. Area		346,360		0.80	4.6
	a) Partitions (Incl. Shear Walls)	139,000	2.19	SF Part. Area	304,520		0.70		
	b) Folding or Sliding Partitions (Doors)	3,334	2.71	SF Part. Area	9,200		0.02		
	c) Doors	183	179.30	Per Door Leaf	32,640		0.08		

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Project: GENERAL PURPOSE OFFICE BUILDING - OTTAWA
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		767,000		1.77	10.3
	a) Stairs, Steps & Ladders	44	1363	Per Flight	60,000		0.14		
	b) Catwalks, Gratings	458	15.28	SF on Plan	7,000		0.02		
	c) Elevators & Hoists	98	7007	Per Stop	700,000		1.61		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		722,470		1.67	9.7
	a) Floor Finishes	395,486	0.58	SF Finished Area	230,160		0.53		
	b) Ceiling Finishes	395,486	0.57	SF Finished Area	227,200		0.52		
	c) Wall Finishes	314,441	0.78	SF Fin. Wall Area	245,020		0.57		
	d) Special Finishes - Mural	2,000	10.00	SF Fin. Wall Area	20,000		0.05		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		30,640		0.07	0.4
	a) Non Instructional	-	-	-	30,640		0.07		
	b) Instructional	-	-	-	-		-		
9	CASH ALLOWANCES	-	-	-		15,000		0.03	0.2
	a) Hardware	202	74.25	Per Unit	15,000		0.03		
	b) -	-	-	-	-		-		

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Project: GENERAL PURPOSE BUILDING - OTTAWA
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		350,000		0.81	4.7
	a) Roughing-In (Standard)	472	429	Per Fixture	202,000		0.47		
	b) Roughing-In (Special)	-	-	Per Fixture	-		-		
	c) Plumbing Fixtures (Standard)	472	176	Per Fixture	83,000		0.19		
	d) Plumbing Fixtures (Special)	-	-	Per Fixture	-		-		
	e) Fire Protection	88	633	Per Cabinet &	55,700		0.13		
		168	55	Per Head	9,300		0.02		
	f) Special Services	-	-	Per Outlet	-		-		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		1,245,000		2.88	16.8
	a) HVAC	-	-	-	1,245,000		2.87		
	b) Special Systems	-	-	-	-				
12	ELECTRICAL	-	-	-		1,004,000		2.45	14.2
	a) Transformers & Distribution				205,350		0.47		
	b) Lighting Fixtures & Branch Wiring				430,100		0.99		
	c) Underfloor Duct Systems				354,000		0.82		
	d) Special Systems				74,550		0.17		
						$7,440,480		17.17	100

$19.96 / NASF

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Project: GENERAL PURPOSE BUILDING - OTTAWA
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (LOW BID)		$ 6,694,000
	DEDUCTIONS:		
	1. Sitework (Estimated)	$ 55,000	
	2. Substitute excavation in earth for rock (Estimated)	34,000	
	3. Demountable Partitions (Specified Allowance)	650,000	
	4. Freezers and Equipment (Estimated) ...	15,000	754,000
B)	ADJUSTED BUILDING CONTRACT COST AT MARCH, 1968		5,940,000
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS		7,440,480
D)	COST INCREASE - FEBRUARY 1968 to SEPTEMBER 1971		$ 1,500,480

The above reflects an increase, or escalation factor, of 25.3% of adjusted original low bid amount.

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Project: GENERAL PURPOSE BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	433,410 Sq. Ft.
Net Assignable Floor Area	372,814 Sq. Ft.x
Cubic Volume	4,848,413 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.86:1 Ratio
Exterior Wall Area/Gross Floor Area ..	0.31:1 Ratio
Roof Area/Gross Floor Area	0.04:1 Ratio
Volume/Gross Floor Area	11.19:1 Ratio
Floors At and Above Grade	22 No.
Floors Below Grade	1 No.

x The lack of office partitioning information precluded the computation in the typical manner of the net assignable floor area of this building. The figure shown does not take into account circulation etc. space created on the typical floors by office partitioning and is therefore higher than would be computed from such "as built" conditions. This fact must be borne in mind when examining cost figures related to this Statistic.

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Project: GENERAL PURPOSE BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Sheet No: 6

1. INDIRECT & GENERAL EXPENSES

Construction Period	23 Months
Winter Construction Period	9 Months
Performance Bond	50%
Fire Insurance by Owner	Yes
Market Conditions	Very Competitive (9 bids, range 11.5%)

2. SUBSTRUCTURE

Type of Soil	Rock
Watertable	Not known
Bearing Capacity of Soil	60,000 lbs./Sq. Ft.
Slope of Site	Nil

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structural Type ..... Material	Reinforced Concrete flat slab
Shear Structure	Centre core walls
Structural Bay Sizes	20'0" x 20'0"
Floor to Floor Heights	10'7"
Structural Depth	8"
Floor Live Loading	75 lbs./Sq. Ft.
Roof Live Loading	100 lbs./Sq. Ft.

Project: GENERAL PURPOSE BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Sheet No: 7

3.(c) ROOF FINISH

Roof Finish Type	4 ply felt and asphalt, gravel surfacing, galvanized flashings, vapour barrier, 1-1/2" rigid insulation.
Rooflights	None
Perimeter/Roof Area	1:38 Ratio
"U" Factor	0.165

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (Walls Above Grade)	38%
% Glazed Area Openable	None
Sun Control Measures	Tinted glass
Wall Thickness	2'6"
Unglazed "U" Factor	0.15
Inside Face Material	Concrete block and reinforced concrete walls
Exterior Face Material	Precast concrete
Exterior Finish	Exposed Sandblasted
Window Type	Aluminum with thermal break, hard coat bronze finish.
Glazing Type	Double.

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area	1:33.33

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partition Types	Type	% Area	Height
- Structural (Load-Bearing)	Concrete	44%	10'0"
- Replaceable	Concrete block	55%	10'0",10'0"
.....	Aluminum glazed	1%	7'6"
		100%	

- Doors Type ..... Solid core wood slats, hollow metal slab, all in pressed metal frames, some with glazed panels, virtually all with aluminum ventilation grilles.
- Doors Ratio ..... 1.43 per 100 Lin. Ft. partition

6. MULTI-STOREY ELEMENTS

Staircase Types ..... Reinforced concrete, steel ships ladders.

Elevator Types ..... 4 No. 3500# passenger, 800 FPM, high rise - 11 floors, 11 openings. 4 No. 3500# passenger, 500 FPM, low rise, 12 floors, 12 openings. 1 No. 1500# freight, 250 FPM, 2 floors, 2 openings.

Hoist Type ..... Nil

7. INTERIOR FINISHES

Floors ..... Generally 1/8" vinyl asbestos tile, epoxy seamless ceramic tile, hardened concrete, slate in lobby.

Ceilings ..... Generally acoustic tile, painted plaster, rubbed and painted concrete.

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7. INTERIOR FINISHES (cont'd.)

Walls	Painted plaster, painted block and concrete, vinyl fabric and ceramic tile.

8. FITTINGS, FIXTURES & EQUIPMENT

(a) Non-Instructional	Washroom accessories, vanities, directory boards, lockers and miscellaneous metal items.
(b) Instructional	Nil

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Brushed aluminum

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type L Copper
Sanitary Soil Piping Type	Cast iron
Sanitary Waste, Ventilating Piping Type	Type DWV Copper
Special Piping Type	None
Plumbing Fixtures Density per 1000 Sq. Ft.	1.10
Special Services	None

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Project: GENERAL PURPOSE BUILDING - OTTAWA
PERFORMANCE & STATISTICAL DATA

Notes:

Sheet No: 10

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	90%
Heating Source	Remote
Fuel	N.A.
Cooling Source	Remote
Air Handling Source	Building
Capacities Heating	27,000,000 BTU/HR
Cooling Capacity	1,200 tons
Air Handling CFM	267,000 CFM
Heating Ratio	62.3 BTU/HR per Sq. Ft.
Cooling Ratio	2.7 tons per 1000 GSF
Ventilation Ratio	0.62 CFM per Sq. Ft.
% Return Air	55% in office areas
% Main Exhaust	45% in office areas
Thermostats per 1000 GSF	1.4
Control Zones	12
Special Systems	None

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12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage 15 kv
- Characteristics of Secondary Voltage .....%.
- KVA Rating/Gross Area Sq. Ft. ...
- Primary Protection ..... Load Break Switch
- Secondary Protection ..... Breakers
- Main Distribution Board ..... Molded Case

2. Distribution

- Related to Type of Structure .... Vertical
- Voltage of Main Distribution ..... 120/208 and 347/600
- Transformation to 120/208 .....

3. Lighting

- Average Intensity of General Lighting in F.C. 100
- Average Cost of General Lighting Fixtures $18.00
- Branch Circuit Characteristics .. EMT
- Switching .....

4. Motors

- Motor Control Centres ..... Included
- Base Building Facilities ..... Air Conditioning

12. ELECTRICAL (cont'd.)

5. Fire Alarm
   - Requirements ..... Minimum
   - Smoke Detection .....

6. Clocks
   - Average Number of Clocks ..... Minimum

7. Telephone ....
   - Average Number of Telephones ... Minimum

8. T.V.
   - Characteristics .....

9. Special Requirements of Typical Occupancy
   - Emergency Generator ..... Approx. $20,000
   - Underfloor Ducts ..... Approx. $354,000
   - Snow Melting ..... Approx. $10,000

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FOOD AND DRUG BUILDING, TORONTO

Project: ONTARIO UNIVERSITIES COST STUDY
FOOD & DRUG BUILDING - TORONTO. ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		193,430		1.93	5.7
2	SUBSTRUCTURE	24,574	3.82	SF Grade Area		83,800		0.79	2.4
	a) Normal Foundations	264	105.87	CY Concrete	27,950		0.26		
	b) Basement Excavations	570,402	0.10	CF Basement Vol.	55,850		0.53		
	c) Special Foundations	-	-		-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	114,957	3.22	SF Struct. Area		369,760		3.50	11.0
	a) Slabs on Grade	24,574	1.26	SF Slab Area	31,000		0.29		
	b) Floor & Roof Construction	90,383	3.46	SF Slab Area	312,860		2.96		
	c) Roof Finish	23,074	1.09	SF Roof Finish	25,900		0.25		
4	EXTERIOR CLADDING	57,460	5.30	SF Wall Area		304,570		2.88	9.0
	a) Walls below Grade	15,220	3.48	SF Wall Area	53,000		0.50		
	b) Walls above Grade	32,692	4.79	SF Wall Area	156,320		1.48		
	c) Windows	9,530	9.53	SF Window Area	95,250		0.90		
	d) Exterior Doors, Entrances, Screen	-	-	SF Opening Area	-		-		
	e) Projections, Balconies, Etc.	-	-		-		-		
5	INTERIOR VERTICAL ELEMENTS	86,757	1.82	SF Part. Area		167,000		1.59	5.0
	a) Partitions	69,303	1.57	SF Part. Area	108,600		1.02		
	b) Folding and Sliding Partitions	10,881	2.30	SF Part. Area	25,000		0.24		
	c) Doors	313	108.63	Per Door Leaf	34,000		0.33		

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Project: ONTARIO UNIVERSITIES COST STUDY
FOOD & DRUG BUILDING - TORONTO. - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		50,000		0.54	1.7
	a) Stairs, Steps & Ladders	23	804.78	Per Flight	18,510		0.18		
	b) Catwalks, Gratings	1,331	4.02	SF on Plan	5,350		0.05		
	c) Elevators & Hoists	4	8275.00	Per Stop	33,100		0.31		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		131,070		1.24	3.8
	a) Floor Finishes	80,967	0.71	SF Finished Area	57,500		0.54		
	b) Ceiling Finishes	82,556	0.61	SF Finished Area	50,570		0.48		
	c) Wall Finishes	125,343	0.18	SF Fin. Wall Area	23,000		0.22		
	d) Special Finishes	-	-		-		-		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		388,590		3.66	11.5
	a) Non Instructional	-	-	-	73,595		0.70		
	b) Instructional	-	-	-	315,000		2.98		
9	CASH ALLOWANCES	-	-	-		41,000		0.39	1.2
	a) Hardware	313	115.00	Per Unit	36,000		0.34		
	b) Tests and Inspections	-	-	-	5,000		0.05		

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Project: ONTARIO UNIVERSITIES COST STUDY
FOOD & DRUG BUILDING - TORONTO. - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		355,340		3.36	10.5
	a) Roughing-In (Standard)	65	1010	Per Fixture	65,700		0.62		
	b) Roughing-In (Special)	265	226	Per Fixture	60,000		0.56		
	c) Plumbing Fixtures (Standard)	65	220	Per Fixture	14,300		0.14		
	d) Plumbing Fixtures (Special)	18	200	Per Fixture	3,600		0.04		
	e) Fire Protection	20	1438	Per Cabinet	28,750		0.27		
	f) Special Services	225	50	Per Head	11,250		0.11		
		-	-	Per Outlet	171,740		1.62		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		820,110		7.76	24.2
	a) HVAC	-	-	-	700,000		6.62		
	b) Special Systems				120,110		1.14		
12	ELECTRICAL	-	-	-		473,670		4.48	14.0
	a) Transformers & Distribution	-	-	-	169,500		1.60		
	b) Lighting Fixtures & Branch Wiring	-	-	-	145,000		1.37		
	c) Underfloor Duct Systems	-	-	-	30,000		0.28		
	d) Special Systems	-	-	-	129,170		1.22		
						$ 3,385,900		32.04	100.00

$62.86 / NASF

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Project:	FOOD & DRUG BUILDING - TORONTO COST RECONCILIATION	Notes:	Sheet No: 4

A)	BUILDING CONTRACT COST (Low Bid)	$ 3,575,000
	DEDUCTIONS	
	1. Site Development	189,100
B)	ADJUSTED BUILDING COST AT NOVEMBER, 1971.	$ 3,385,900

N.B. All costs in Analysis have been reconciled to low bidder's costs provided by Client.

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Project: FOOD & DRUG BUILDING - TORONTO
PERFORMANCE & STATISTICAL DATA

Sheet No: 5

GENERAL DATA:

Gross Floor Area	105,675 Sq. Ft.
Net Assignable Floor Area	53,865 Sq. Ft.
Cubic Volume	1,327,832 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.51:1 Ratio
Exterior Wall Area/Gross Floor Area	0.54:1 Ratio
Roof Area/Gross Floor Area	0.23:1 Ratio
Volume/Gross Floor Area	12.57:1 Ratio
Floors At and Above Grade	3 No.
Floors Below Grade	1 No. (Partial)

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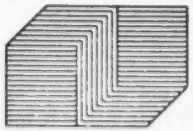
Project:	FOOD & DRUG BUILDING - TORONTO PERFORMANCE & STATISTICAL DATA	Sheet No: 6

1. INDIRECT & GENERAL EXPENSES

Construction Period	20 months
Winter Construction Period	9 months
Performance Bond	50 Per Cent.
Fire Insurance by Owner	No.
Market Conditions	Depressed market, keen bidding - 13 bids - Range 23% (11.7% discounting the high bid of $4.4 million)

2. SUBSTRUCTURE

Type of Soil	Generally silty sand to approx. 10 ft. below grade, then small gravel.
Watertable	Ft. below Grade
Bearing Capacity of Soil	12,000 lbs./Sq.Ft.
Slope of Site	5 Per Cent



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Project: FOOD & DRUG BUILDING - TORONTO
PERFORMANCE & STATISTICAL DATA

Sheet No: 7

3. (b) HORIZONTAL STRUCTURAL ELEMENTS

Structure Type and Material	Reinforced concrete, flat slabs and columns with drop panels
Shear Structure	Nil
Structural Bay Sizes	26' x 26'
Floor to Floor Heights	12'-0"
Structural Depth	10-1/2" x 6" drop panels
Floor Live Loading	Generally 80-100 lbs./Sq. Ft.
Roof Live Loading	40 lbs./Sq. Ft.

3. (c) ROOF FINISH

Roof Finish Type	Built up roofing on 2" rigid insulation
Rooflights	0.5 Per Cent.
Perimeter/Roof Area	1:20 Ratio
'U' Factor	

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Project: FOOD & DRUG BUILDING - TORONTO
PERFORMANCE AND STATISTICAL DATA

Sheet No: 8

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (above grade)	29 Per Cent
% Gross Area Openable	None
Sun Control Measures	Tinted Glass
Wall Thickness	10 inches
Unglazed 'U' Factor	
Inside Face Material	Concrete Block
Exterior Face Material and Finish	4" Face Brick, insulated aluminum panel cladding and aluminum louvres to penthouse.
Window Type	Aluminum with baked acrylic enamel.
Glazing Type	Double

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area ..... 1:14.49 Ratio

Partition Types

	Type	% Area	Height
- Replaceable .....)	Concrete Block	69	11' 2" & 16' 0"
.....)	Brick	4	11' 2"
)	Drywall and Steel Stud	11	11' 2"
.....)			

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5. INTERIOR VERTICAL ELEMENTS (cont'd.)

Partition Types	Type	% Area	Height
- Sliding and Folding		16	
Door Types	Plastic Laminate with Fixed Sidelights and H.M. Frames		
Doors Ratio	4.2 per 100 Lin. Ft. Partition		

6. MULTI-STOREY ELEMENTS

Staircase Types	Poured Concrete
Elevator Types	Electric traction - 4000# passenger, 200 FPM, 4 Floors, 4 Openings.

7. INTERIOR FINISHES

Floors	Mainly vinyl asbestos tile, linoleum carpet and quarry tile.
Ceilings	Mainly painted concrete, suspended acoustic tile, suspended painted drywall.
Walls	Mainly vinyl acrylic and paint to block, epoxy paint, brick facing ceramic tile.

8. FITTINGS, FIXTURES AND EQUIPMENT

Non-Instructional	Washroom accessories, millwork, chimney, miscellaneous specialties.
Instructional	Lab. furniture.

9. CASH ALLOWANCES

(a) Finishing Hardware

- Type	Standard
- Finish	Brushed Aluminum

10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type L and K Copper
Sanitary Soil Piping Type	Cast Iron
Sanitary Waste,Ventilating Piping Type	Type DWV Copper
Special Piping Type	High silicone cast iron, glass, PVC, polyproplene.
Plumbing Fixtures Density per 1000 S.F.	.78
Special Services	Gas, air, vacuum, steam, acid waste, de-mineralized water, distilled water, nitrogen.

Project: FOOD & DRUG BUILDING - TORONTO
PERFORMANCE & STATISTICAL DATA

Notes:

Sheet No: 11

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	75%
Heating Source	Building
Fuel	Oil and gas
Cooling Source	Building
Air Handling Source	Building
Capacities Heating	11,172,000 BTU/HR
Cooling Capacity	370 tons
Air Handling CFM	101,685 CFM
Heating Ratio	110 BTU/HR per Sq. Ft.
Cooling Ratio	3.50 tons per 1000 GSF
Ventilation Ratio	.96 CFM per Sq. Ft.
% Return Air	75%
% Main Exhaust	25%
Thermostats per 1000 GSF	1.20
Control Zones	None
Special Systems	Fume hood exhaust and fans, special controls.

Project: FOOD & DRUG BUILDING - TORONTO
PERFORMANCE & STATISTICAL DATA

Sheet No: 12

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage	27,600 kv
- Characteristics of Secondary Voltage	600
- KVA Rating/Gross Area S.F. ...	15 Watts/Sq. Ft.
- Primary Protection	Load Break Switch
- Secondary Protection	Breaker
- Main Distribution Board	Molded Case

2. Distribution

- Related to Type of Structure .	Horizontal
- Transformation to 120/208v ...	Scattered

3. Lighting

- Average Intensity of General Lighting in F.C.	70
- Average cost of General Lighting Fixtures	$25.00
- Branch Circuit Characteristics	Galvanized
- Switching	Local Switching

4. Motors

- Motor Control Centres	Included

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Project:	FOOD & DRUG BUILDING - TORONTO PERFORMANCE & STATISTICAL DATA	Notes:	Sheet No: 13

12. ELECTRICAL (cont'd.)

4. Motors (cont'd.)

- Base Building Facilities	Air Conditioning

5. Fire Alarm

- Requirements	Heavy
- Smoke Detection	Minimum

6. Clocks

- Average Number Clocks	1/2000 Sq. Ft.

7. Telephone

- Average Number Telephones ...	1/200 Sq. Ft.

8. T.V.

- Characteristics	Close Circuit System - not applicable
.....	Empty Conduit Network - not applicable

9. Special Requirements of Typical Occupancy

- Vault Type Substation	
- Snow Melting	$4,500 minimum
- Sound Minimal	$1,200 minimum
- Emergency	$13,000 minimum
- Lightning Protection	$12,000

GEORGIAN CAAT IIIA, BARRIE

Project: GEORGIAN CAAT - IIIA
COST ANALYSIS

ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 1

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
1	INDIRECT & GENERAL EXPENSES	-	-	-		76,000		1.76	7.4
2	SUBSTRUCTURE	23,396	0.99	SF Grade Area		23,140		0.54	2.2
	a) Normal Foundations	139	16647	CY Concrete	23,140		0.54		
	b) Basement Excavations	-	-	CF Basement Vol.	-		-		
	c) Special Foundations	-	-		-		-		
3	HORIZONTAL STRUCTURAL ELEMENTS	66,569	2.57	SF Struct. Area		171,000		3.96	16.6
	a) Slabs on Grade	24,033	0.95	SF Slab Area	22,800		0.53		
	b) Floor & Roof Construction	42,536	2.70	SF Slab Area	115,050		2.66		
	c) Roof Finish	23,427	1.42	SF Roof Finish	33,150		0.77		
4	EXTERIOR CLADDING	23,846	5.62	SF Wall Area		134,080		3.11	13.0
	a) Walls below Grade	-	-	SF Wall Area	-		-		
	b) Walls above Grade	21,310	4.83	SF Wall Area	103,030		2.39		
	c) Windows, Entrances, Screens	2,132	13.44	SF Window Area	28,660		0.66		
	d) Exterior Doors,	147	11.90	SF Opening Area	1,750		0.04		
	e) Projections, Balconies, Etc.	257	2.50	SF Soffit Area	640		0.02		
5	INTERIOR VERTICAL ELEMENTS	48,063	1.77	SF Part. Area		85,140		1.97	8.2
	a) Partitions	45,093	1.50	SF Part. Area	68,040		1.58		
	b) Folding Partitions	60	8.34	SF Part. Area	500		0.01		
	c) Doors	110	15000	Per Door Leaf	16,600		0.38		

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Project: GEORGIAN CAAT - III A
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 2

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
6	MULTI-STOREY ELEMENTS	-	-	-		9,900		0.23	0.9
	a) Stairs, Steps & Ladders	4	2475	Per Flight	9,900		0.23		
	b) Catwalks, Gratings	-	-	SF on Plan	-		-		
	c) Elevators & Hoists	-	-	Per Stop	-		-		
	d) Escalators	-	-	Per Floor	-		-		
7	INTERIOR FINISHES	-	-	-		90,000		2.08	8.7
	a) Floor Finishes	40,777	0.83	SF Finished Area	33,840		0.78		
	b) Ceiling Finishes	40,777	0.53	SF Finished Area	21,710		0.50		
	c) Wall Finishes	95,410	0.36	SF Fin. Wall Area	34,450		0.80		
	d) Special Finishes	-	-		-		-		
8	FITTINGS, FIXTURES & EQUIPMENT	-	-	-		43,500		1.01	4.2
	a) Non Instructional	-	-	-	13,050		0.30		
	b) Instructional	-	-	-	30,450		0.71		
9	CASH ALLOWANCES	-	-	-		20,500		0.48	2.0
	a) Hardware	110	163.64	Per Unit	18,000		0.42		
	b) Inspection and Testing	-	-	-	2,500		0.06		

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Project: GEORGIAN CAAT - III A
COST ANALYSIS - ALL COSTS ON A SEPTEMBER 1971 TORONTO BASE

Sheet No: 3

No.	ELEMENT	ELEMENTAL COST			AMOUNT		UNIT RATE / OGSF		%
		Quantity	Unit Rate	Unit of Measure	Sub-Element	Element	Sub-Element	Element	
10	PLUMBING & DRAINS	-	-	-		72,500		1.68	7.0
	a) Roughing-In (Standard)	46	739	Per Fixture	34,000		0.79		
	b) Roughing-In (Special)	34	558	Per Fixture	19,000		0.44		
	c) Plumbing Fixtures (Standard)	46	217	Per Fixture	10,000		0.23		
	d) Plumbing Fixtures (Special)	16	188	Per Fixture	3,000		0.07		
	e) Fire Protection	-	-	Per Cabinet or Per Head	3,500		0.08		
	f) Special Services	-	-	Per Outlet	3,000		0.07		
11	HEATING, VENTILATING & AIR COND'G.	-	-	-		133,000		3.08	12.9
	a) HVAC	-	-	-	105,000		2.43		
	b) Special Systems	-	-	-	28,000		0.65		
12	ELECTRICAL	-	-	-		173,800		4.03	16.9
	a) Transformers & Distribution	-	-	-	53,540		1.24		
	b) Lighting Fixtures & Branch Wiring	-	-	-	98,300		2.28		
	c) Underfloor Duct Systems	-	-	-	-		-		
	d) Special Systems	-	-	-	21,960		0.51		
						1032,200	*	23.93	100
	Federal Sales Tax Rebate					(30,900)		(0.73)	
						1001,300		23.20	

* $34.17 /NASF

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Project: GEORGIAN CAAT - III A
COST RECONCILIATION

Sheet No: 4

A)	BUILDING CONTRACT COST (LOW BID)		$1,021,580
	DEDUCTIONS:		
	1. Exterior Work (Low Bid)	$ 23,000	
	2. Asphalt Paving (Low Bid)	5,500	
	3. Kitchen Equipment (Low Bid)	19,000	
	4. Contingency (Specified Allowance)	45,000	92,500
			$ 929,080
	5. Federal Sales Tax		27,880
B)	ADJUSTED BUILDING CONTRACT COST AT MAY, 1970		$ 901,200
C)	BUILDING CONTRACT COST AT SEPTEMBER 1971 PER COST ANALYSIS		1,001,300
D)	COST INCREASE MAY 1970 TO SEPTEMBER 1971		$ 100,100

The above reflects an increase, or escalation factor of 11% of adjusted original low bid amount.

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Project: GEORGIAN CAAT - III A
PERFORMANCE & STATISTICAL DATA

Sheet No: 9

GENERAL DATA:

Gross Floor Area	43,140 Sq. Ft.
Net Assignable Floor Area	30,210 Sq. Ft.
Cubic Volume	621,440 Cu. Ft.
Net Assignable Floor Area/Gross Floor Area	0.70:1 Ratio
Exterior Wall Area/Gross Floor Area .	0.55:1 Ratio
Roof Area/Gross Floor Area	0.55:1 Ratio
Volume/Gross Floor Area	14.41:1 Ratio
Floors At and Above Grade	2 No.
Floors Below Grade	None

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Project: GEORGIAN CAAT - IIIA
PERFORMANCE & STATISTICAL DATA

Sheet No: 8

1. INDIRECT AND GENERAL EXPENSES

Construction Period	16 Months
Winter Construction Period	5 Months
Performance Bond	50%
Fire Insurance by Owner	Yes
Market Conditions	Average (5 bids, range 4%)

2. SUBSTRUCTURE

Type of Soil	Silty sand
Watertable	13'0" below grade
Bearing Capacity of Soil	6000 lbs./Sq. Ft.
Slope of Site	2%

3.(b) HORIZONTAL STRUCTURAL ELEMENTS

Structure Type and Material	Structural steel frame with OWSJ: 2nd floor - 2-1/2" concrete slab on vertical rib pan" Roof -1-1/2" metal deck.
Shear Structure	None
Structural Bay Sizes	Average 19'6" x 35'0"
Floor to Floor Heights	14'0"
Structural Depth	2-1/2" (slab) 16" (OWSJ)
Floor Live Loading	100 lbs./Sq. Ft.
Roof Live Loading	60 lbs./Sq. Ft.

3. (c)ROOF FINISH

Roof Finish Type	4 ply built-up felt and asphalt, gravel surfacing, vapour barrier, 1-1/2" insulation, prefabricated alum. flashings with baked enamel finish.
Rooflights	None
Perimeter/Roof Area	1:31 Ratio
"U" Factor	0.12

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Project: GEORGIAN CAAT - IIIA
PERFORMANCE & STATISTICAL DATA

Sheet No: 7

4. EXTERIOR CLADDING

% Total Sq. Ft. Glazed (Above Grade).	6.4%
% Glazed Area Openable	None
Sun Control Measures	Tinted glass to sloped glazing.
Wall Thickness	10", 12", 14"
Unglazed "U" Factor	Average 0.11
Inside Face Material	Concrete Block
Exterior Face Material and Finish ..	Face brick and precast concrete with striated finish.
Window Type	Single windows, curtainwall and sloped aluminum with Duracron finish. (Sloped area 44% of total)
Glazing Type	Double.

5. INTERIOR VERTICAL ELEMENTS

Linear Feet Partitions/Gross Floor Area ..... 1:12.64 Ratio

Partition Types

	Type	% Area	Height
- Replaceable	Block	26.62%	13'9"
.....	Drywall	71.36%	10'0" and 13'9"
.....	Glazed	0.80%	(7'2")
.....	Wiremesh	1.09%	(10'4")
- Folding	Soundmaster 240	0.13%	
		100.00%	

Doors Types ..... HM, wood and aluminum: 20% glazed

Doors Ratio ..... 3.23 per 100 Lin. Ft. Partition.

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6. MULTI-STOREY ELEMENTS

Staircase Types	Steel pan with concrete fill, quarry tile finish.
Elevator Types	None
Hoist Types	None

7. INTERIOR FINISHES

Floors	Generally carpet, hardened concrete, 1/8" vinyl asbestos tile, quarry and ceramic tile.
Ceilings	Generally suspended 2' x 4' lay-in acoustic tile, painted exposed structure, suspended drywall, suspended lath and plaster.
Walls	Generally paint to drywall and block; plastic paint ceramic tile.

8. FITTINGS, FIXTURES AND EQUIPMENT

(a) Non-Instructional	Washroom accessories, manufactured specialties, counters, cupboards, vanities, miscellaneous metal items.
(b) Instructional	Laboratory furniture

9. CASH ALLOWANCES

(a) Finishing Hardware	
- Type	Standard
- Finish	Generally brushed chrome.
(b) Inspection and Testing	soil, compaction, structural steel, concrete, roofing.

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10. PLUMBING AND DRAINS

Hot and Cold Water Piping Type	Type L Copper
Sanitary Soil Piping Type	Cast iron and transite
Sanitary Waste, Ventilating Piping Type	Type DWV Copper and galvanized iron
Special Piping Type	Proxylene
Plumbing Fixtures Density per 1000 S.F.	1.49
Special Services	Acid drains

11. HEATING, VENTILATING, AIR CONDITIONING (HVAC)

% Building Served by AC	100%
Heating Source	Building
Fuel	Gas
Cooling Source	Building
Air Handling Source	Building
Capacities Heating	1,675,000 BTU/LP (including 300,000 electric)
Cooling Capacity	99 tons
Air Handling CFM	39,860 CFM
Heating Ratio	40 BTU/HP per sq. ft.
Cooling Ratio	2.4 tons per 1000 GSF
Ventilation Ratio	0.96 CFM per sq. ft.
% Return Air	64%
% Main Exhaust	36%

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11. HEATING, VENTILATING, AIR CONDITIONING (HVAC) (cont'd.)

Thermostats per 1000 GSF	1.1
Control Zones	43
Special Services	Laboratory and shop exhaust systems

12. ELECTRICAL

1. Substation

- Characteristics of Primary Voltage	13.8/5kv (5kva temporary tap)
- Characteristics of Secondary Voltage	120/208l
- KVA rating/Gross Area S.F. ...	1000/1333 (4 watts/sq. ft. lighting)
- Primary Protection	Load Break Switch
- Secondary Protection	Breaker
- Main Distribution Board	Fusible Units

2. Distribution

- Related to Type of Structure .	Mixed
- Voltage of Main Distribution .	120/208
- Transformation to 120/208V ...	Scattered

3. Lighting

- Average intensity of General Lighting in F.C.	100
- Average Cost of General Lighting Fixtures	$34.00

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12. ELECTRICAL (cont'd.)

3. Lighting (cont'd.)

- Branch Circuit Characteristics Walls	EMT
- Branch Circuit Characteristics Ceilings	B/X
- Switching	Local switching

4. Motors

- Motor Control Centres	Excluded
- Base Building Facilities	Air Conditioning

5. Fire Alarm

- Requirements	Minimum
- Smoke Detection	Minimum

6. Clocks

- Average Number Clocks	1 Room sq. ft.

7. Telephone

- Average Number Telephones ...	1 Office sq. ft.

8. T.V.

- Characteristics	Empty Conduit Network

9. Special Requirements of Typical Occupancy

- Laboratory S.F./Cross Area ..	27.11%
- Classrooms	8.44%

ELEMENTAL UNIT RATES

No.	Element	Unit of Measurement	PRELIMINARY UNIT RATES											
			Child Study Ottawa	Law Building Windsor	Crop Science Guelph	Metric Science York	Math & Comput. Waterloo	Engineer. IV, Waterloo	Carleton Electric Toronto	C.B.B. Ottawa	Varett. Bus. Ottawa	Conrad Powell Ottawa	Food & Drug Toronto	Canadian Hist. Ottawa
1.	INDIRECT AND GENERAL EXPENSES	SF OGSF	3.08	2.53	3.01	2.95	2.20	2.75	1.77	1.76	1.08	1.12	1.03	1.76
2.	SUBSTRUCTURE	SF Grade Area	5.81	3.88	3.08	1.65	5.11	3.68	0.88	0.60	4.70	2.55	3.82	0.58
	a) Normal Foundations	CY Concrete	110.54	92.85	139.37	57.98	55.35	131.23	112.00	60.76	53.10	54.13	[illegible] .7	166.47
	b) Basement Excavations	SF Excav.	0.10	0.07	0.45	0.10	0.11	0.07	-	0.10	0.02	0.07	0.10	-
	c) Special Foundations	SF Grade Area	80.00	80.00	-	-	80.27	-	-	-	-	-	-	-
3.	HORIZONTAL STRUCTURAL ELEMENTS	SF Struct. Area	3.40	4.24	4.03	3.44	3.17	4.22	2.80	3.[illegible]	2.81	[illegible]	[illegible]	[illegible] .7
	a) Slabs on Grade	SF Slab Area	1.26	1.06	1.86	2.10	0.04	1.13	1.02	1.04	0.45	1.02	1.20	0.45
	b) Floor and Roof Constrn.	SF Slab Area	3.87	4.76	3.33	3.42	3.74	4.75	3.61	4.07	5.45	3.44	3.46	3.78
	c) Roof Finish	SF Roof Area	2.17	2.03	1.15	1.08	1.63	2.43	1.43	1.71	1.71	1.45	1.45	1.94
4.	EXTERIOR CLADDING	SF Wall Area	6.78	5.18	5.62	5.82	4.26	5.77	4.62	4.62	5.25	[illegible]	5.30	5.62
	a) Walls Below Grade	SF Wall Area	14.25	8.10	5.17	4.59	4.82	4.27	-	3.72	3.32	[illegible]	5.46	
	b) Walls Above Grade	SF Wall Area	5.58	4.55	4.75	4.62	4.72	5.16	4.23	2.14	[illegible]	[illegible]	4.75	4.43
	c) Windows	SF Window Area	12.28	12.29	10.50	14.22	7.02	11.64	12.00	10.44	8.75	7.[illegible]	9.59	13.84
	d) Exterior Doors, Entrances, Screens	SF Opening Area	10.62	12.67	10.52	9.72	11.72	8.55	9.45	15.11	16.84	[illegible]	-	11.[illegible]
	e) Projections, Balconies etc.	SF Soffit Area	2.01	2.50	4.85	3.01	3.35	4.71	3.20	4.67	-	-	-	2.[illegible]
5.	INTERIOR VERTICAL ELEMENTS	SF Part. Area	2.45	2.50	2.38	2.58	1.71	2.42	2.05	2.07	2.02	2.35	1.52	1.77
	a) Partitions	SF Part. Area	1.07	1.65	1.82	2.23	1.57	2.28	2.40	2.30	1.85	2.13	1.57	1.50
	b) Folding, Sliding Parts.	SF Part. Area	14.34	2.42	12.02	14.00	14.00	13.00	-	2.73	-	2.71	2.30	0.34
	c) Doors	Per Door Leaf	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			$Millions	$[illegible]			$Millions Cubic							

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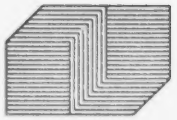
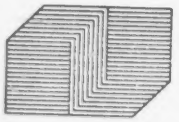


COUNCIL OF ONTARIO UNIVERSITIES - COST STUDY

Hanscomb Roy Associates

No.	Element	Unit of Measurement	HISTORICAL UNIT RATES											
			Child Study Ottawa	Law Building Windsor	Crop Science Guelph	Ontario Science York	Math & Computer Waterloo	Lakehead Un. Thunder Bay	Northern Electric Complex	C.D.L. Ottawa	Waterloo U.B. Ottawa	Trent Univ. Phase 2 Peterboro	Food & Drug Toronto	Technical Educ. Centre
6.	MULTI-STOREY ELEMENTS													
	a) Stairs, Ramps, Landings	Per Flight/Flr.	2500	1807	1898	1772	2838	1675	2500	1629	1157	1243	805	2475
	b) Catwalks, Fronting	SF or Plan	-	-	9.58	14.51	8.53	5.50	-	-	-	15.78	4.62	-
	c) Elevators and Hoists	Per Stop/Flr.	6366	6750	6700	9939	5666	6500	7925	5334	4504	7847	9272	-
	d) Escalators	Per Floor	-	-	-	-	-	-	-	-	-	-	-	-
7.	INTERIOR FINISHES													
	a) Floors	SF Finished Area	1.54	1.05	1.86	0.42	0.70	0.85	0.49	0.87	0.95	0.59	0.71	0.83
	b) Ceilings	SF Finished Area	1.34	1.07	0.36	0.61	0.63	0.48	1.50	0.71	0.52	0.67	0.61	0.93
	c) Walls	SF Finished Area	0.63	0.40	0.46	0.20	0.20	0.54	0.46	0.40	0.63	0.78	0.18	0.26
	d) Special	SF Finished Area	-	-	0.38	1.54	-	-	3.06	-	-	19.09	-	-
8.	FITTINGS, FIXTURES & EQUIPMENT													
	a) Non-Instructional	Per SF OGSF	0.87	1.37	0.12	0.66	0.40	0.88	0.30	0.14	0.12	0.07	0.76	0.25
	b) Instructional	Per SF OGSF	0.12	0.4	3.10	3.48	0.23	2.12	-	0.86	-	-	2.48	0.71
9.	CASH ALLOWANCES													
	a) Hardware	Per Unit	125.00	155.00	129.04	153.00	152.00	135.00	150.00	244.00	75.00	74.22	115.00	103.64
	b) Testing and Inspection	Per SF OGSF	0.20	0.32	0.35	0.02	0.05	0.03	-	0.33	-	-	0.35	0.35



COUNCIL OF ONTARIO UNIVERSITIES - COST STUDY

Hanscomb
Roy
Associates

No.	Element	Unit of Measurement	ELEMENTAL UNIT RATES											
			Cold Study Ottawa	Low Building Windsor	Owen Sciences Guelph	Petrie Science Work	Wath & Corbett Waterloo	Fraticum. IV. Waterloo	Northern Electric Toronto	S.D.L. Ottawa	Varette O.U. Ottawa	General Sci.Bldg. Ottawa	Road & Hwy Toronto	Cochrane Hlth. Sciences
1	PLUMBING AND DRAINS													
	a) Roughing In (Standard)	Per Fixture	233	240	250	133	725	1231	955	457	331	458	1 140	730
	b) Roughing-In (Special)	Per Fixture	87	-	430	273	-	380	-	-	-	-	420	558
	c) Plumbing Fixtures (Standard)	Per Fixture	215	223	227	201	280	420	260	218	190	170	420	217
	d) Plumbing Fixtures (Special)	Per Fixture	226	-	290	200	-	154	-	-	-	-	20	109
	e) Fire Protection	Per Cab/Hose	1250	450	1111	1250	710	1150	451	1500	720/Hose	70/Hose	720/Hose	1 [illegible]
	f) Special Services	Of Gas	-	-	-	-	-	0.20	-	20	-	-	1.00	[illegible]
2	HEATING, VENTILATING AND AIR CONDITIONING													
	a) HVAC	SF Area	0.98	0.63	1.10	0.71	0.42	0.34	0.60	1.20	0.77	0.77	[illegible]	[illegible]
	b) Special Systems	SF Area	-	-	3.77	1.50	1.80	0.42	-	1.62	-	-	1.15	[illegible]
3	ELECTRICAL													
	a) Transformers and Distribution	SF Area	0.50	0.60	0.61	0.50	0.71	0.33	1.75	1.53	0.32	0.87	[illegible]	[illegible]
	b) Lighting Fixtures and Branch Wiring	SF Area	1.11	1.36	0.93	1.07	1.20	[illegible]	1.2	0.95	1.37	-	[illegible]	[illegible]
	c) Underfloor Duct Systems	SF Area	-	-	0.24	0.21	0.58	[illegible]	0.31	-	0.03	0.46	0.42	-
	d) Special Systems	SF Area	2.40	1.70	1.45	1.01	.92	2.40	3.47	2.42	1.21	1.37	1.60	1.42
														[illegible] Sq. Metres